MAY 3 1922 Medical Lib.

OFFICIAL JOURNAL OF THE AMERICAN COLLEGE OF SURGEONS

ANNUAL SUBSCRIPTION: UNITED STATES AND CANADA, $12.00; FOREIGN, $14.00.

Volume XXXIV MAY, 1922 Number 5

Surgery, Gynecology and Obstetrics

WITH

International Abstract of Surgery

EDITORIAL STAFF

FOR AMERICAN COLLEGE OF SURGEONS

William J. Mayo, M.D.

Albert J. Ochsner, M.D. John M. T. Finney, M.D.

George W. Crile, M.D. Harvey Cushing, M.D. J. Bentley Squier, M.D.

George E. de Schweinitz, M.D. John L. Porter, M.D. T. J. Watkins, M.D.

E. Wyllys Andrews, M.D. Frederic A. Besley, M.D. W. R. Cubbins, M.D.

George E. Armstrong, M.D. Rudolph Matas, M.D.

FOR THE BRITISH EMPIRE

Sir Arthur Mayo-Robson, K.B.E., C.B., C.V.O., D.Sc.

Sir Berkeley Moynihan, K.C.M.G., C.B. J. Rutherford Morison, M.B., F.R.C.S.

Sir Harold J. Stiles, K.B.E., F.R.C.S. (Edin.) Thomas W. Eden, M.D., F.R.C.S.

Sir William de C. Wheeler, M.D., F.R.C.S.I.

Franklin H. Martin, M.D., Managing Editor

Allen B. Kanavel, M.D., Associate Editor

EDITORIAL AND BUSINESS OFFICES: 30 N. Michigan Ave., Chicago, Illinois, U. S. A.

PUBLISHERS FOR GREAT BRITAIN: Bailliere, Tindall & Cox, 8 Henrietta St., Covent Garden, London, W. C., England

Carman's SECOND EDITION

Roentgen Diagnosis of Alimentary Disease

The *second edition* of this work is 100 pages larger than the first edition and contains 122 additional illustrations. Two new chapters appear, one on hour-glass stomach, and the other a chronologic abstract of the published work on pneumoperitoneal diagnosis of abdominal lesions.

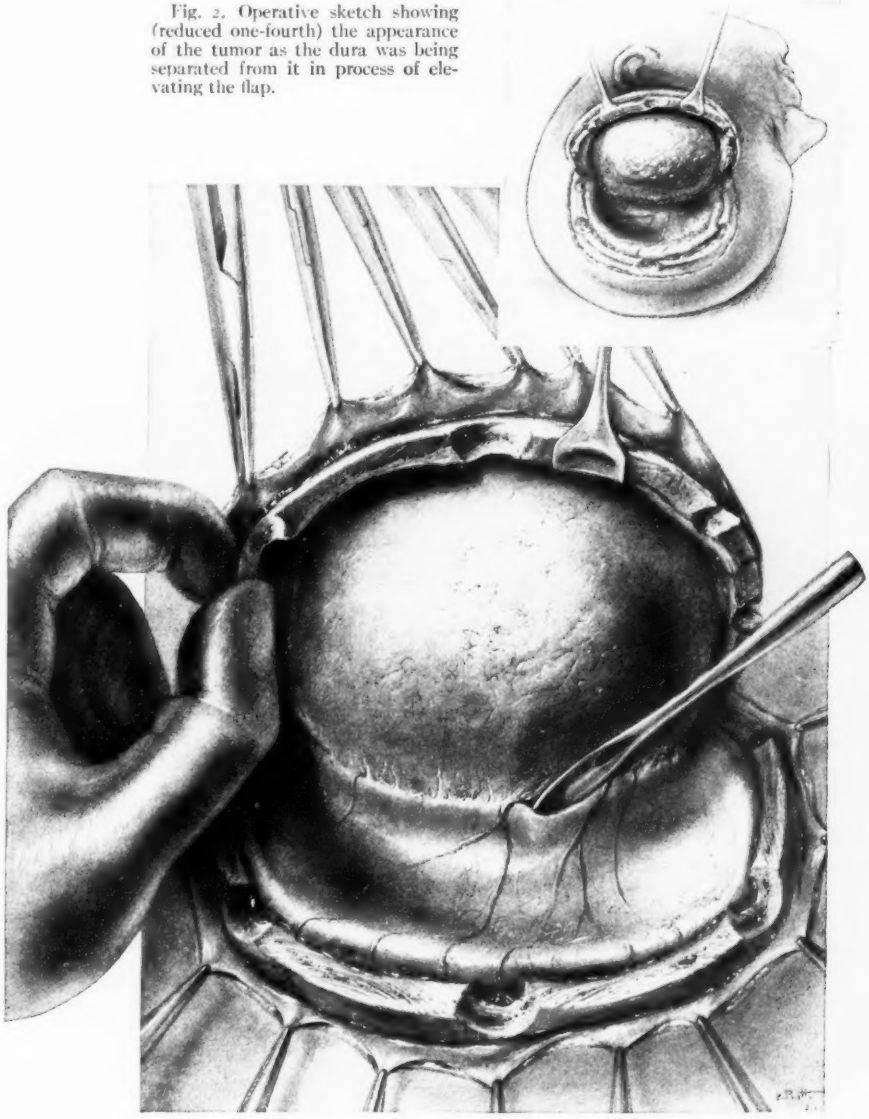
Octavo of 676 pages, with 626 illustrations. By Russell D. Carman, M.D., Head of Section of Roentgenology, Division of Medicine, The Mayo Clinic, Rochester, Minn. Cloth, $8.50 (42s) net

SAUNDERS, *Publishers*

AN IMPORTANT BOOK IS ANNOUNCED ON PAGE 13

Entered as second-class matter May 22, 1913, at the postoffice at Chicago, Ill., under the Act of Congress, March 3, 1879.
Published monthly. Copyright, 1922, by The Surgical Publishing Company of Chicago

Fig. 2. Operative sketch showing (reduced one-fourth) the appearance of the tumor as the dura was being separated from it in process of elevating the flap.



Large Epidermal Cholesteatoma of the Parietotemporal Region Deforming the Left Hemisphere without Cerebral Symptoms.—Harvey Cushing.

SURGERY, GYNECOLOGY AND OBSTETRICS

AN INTERNATIONAL MAGAZINE PUBLISHED MONTHLY

VOLUME XXXIV MAY, 1922 NUMBER 5

A LARGE EPIDERMAL CHOLESTEATOMA OF THE PARIETO-TEMPORAL REGION DEFORMING THE LEFT HEMISPHERE WITHOUT CEREBRAL SYMPTOMS[1]

BY HARVEY CUSHING, M.D.
Professor of Surgery, Harvard Medical School

CHOLESTEATOMATOUS masses in the temporal bone usually ascribed to otitis media desquamativa are not particularly uncommon, and in the various journals devoted to otology there may be found from year to year the report of one or more cases. They are generally regarded by writers as something apart from the true cholesteatomata or pearly tumors which are encountered elsewhere within the cranium.[2] Though from my reading on the subject I am inclined to believe that this view may be erroneous, the matter need not detain us, for this presentation is concerned with a cholesteatoma which obviously had no connection with the middle ear.[3]

The cholesteatomata remote from the temporal bone are unusual tumors and certain types of them excessively so. They are so uncommon, indeed, and excite so much interest when disclosed unexpectedly post-mortem, or more rarely in the course of an operation on the brain, that they are prone to find their way into medical literature. So far as I am aware, the condition has never been diagnosed except at autopsy or operation. Certain of these lesions, however, despite their obscurity, should be quite capable of recognition because of the characteristic changes in the bone which the X-ray may disclose. This was true of the case to be presented.

In the history of these tumors there are three names with which all articles on the subject usually begin—those of Cruveilhier, of Johannes Mueller, and of Virchow—though that of Esmarch possibly deserves to be added to them. In his famous *Anatomie*

[2] There has been no satisfactory key-word for these lesions. Paget's designation of "cutaneous proliferating cyst" is probably the best, but its length is prohibitive. "Pearly tumor" merely describes the striking surface appearance of the leptomeningeal tumors which lie free of attachments. Mueller successfully rubricated the equally insufficient term "cholesteatoma" based merely upon the crystalline depositions in the central fatty mass. Virchow endeavored to replace "pearly tumor" by a term from the Greek, namely, "margaritoma," which did not survive. "*Cholesteatoma* seems likely to remain, for it probably conveys most to most people.

[3] It is my impression that many of the cholesteatomata reported by otologists are true epidermoid tumors of the sort under discussion, which originate from aberrant epidermal "rests," laid down in the temporal bone during the early formation of the complicated special sense organ which it contains. Certainly all of the tumors which have a demonstrable epidermal membrane such as those encountered more often in the mastoid process and which may reach a considerable size, are in all likelihood actual Cruveilhian tumors. It is not improbable, indeed, that in many of the recorded cases the cholesteatoma itself was responsible for the otitis media, rather than the reverse. Excessive desquamation of epidermoid cells which have grown from the canal into the middle ear in a long-standing case of otitis media may doubtless occur and produce a pseudo-cholesteatoma, but another explanation of the process seems the more likely for the majority of the cases. The tumors are said to vary in size from a hemp seed to a walnut and their most frequent situation is in the mastoid process, the upper portion of the tympanic cavity, and the external attic. From these points as the cystic growths enlarge, they cause pressure absorption of bone with ultimate lodgement of the lesion between skull and dura. A typical example of a walnut-sized epidermal cholesteatoma of the mastoid is shown in Politzer's "Diseases of the Ear."

For those who would pursue this subject, attention may be called to a most important discussion which has been rarely quoted but which took place at two sessions of the Berlin Medical Society early in 1889. Virchow at this time gave at length his ideas concerning these tumors, which he regarded as common. He had found "Perlgeschwuelste" in 15 out of 53 consecutive cases of fatal otic suppuration which had come to autopsy (Perlgeschwuelste des Felsenbeins, etc. Berl. klin. Wchnschr., 1889, xxvi, 216 and 236).

[1] Case presented to the Boston Society of Psychiatry and Neurology at a meeting at the Peter Bent Brigham Hospital, January 20, 1921.

Pathologique (1829), Cruveilhier pictured and described one of these tumors which, happening to be of the leptomeningeal form with a highly refractile and nodular surface, he named "*tumeur perlee.*" Two examples of the same kind of tumor had previously been recorded by Leprestre and by Dupuytren with sufficient clearness to make them capable of identification. A wax preparation of Dupuytren's case is in the collection of the *École de Médecine.*

In 1838 Johannes Mueller[1] described three cases, and gave the name "cholesteatoma" to the lesions. Curiously enough, one of them was an example of the exceptionally rare type with which this paper is concerned: a tumor which apparently arose in the diploe and involved the upper middle portion of a hemisphere, having destroyed the inner table of the skull.

Finally, in 1855, Virchow returned to the term "pearly tumor" in an article[2] in which nine cases were discussed, two of the temporal bone and three of the basal arachnoid. The other four tumors which he included because of their cholesteatomatous contents occurred elsewhere in the body (breast, testis, etc.), and need not be considered in our present connection.

The following year (1856) Esmarch[3] gave a brief account of what appears to have been the first intracranial cholesteatoma surgically treated, a tumor of the frontal region, the growth having apparently arisen from the bones of the cranial vault.

Since these early papers, such articles as have appeared under the title of cholesteatoma have, for the most part, been devoted merely to individual case reports, though some of the more important of them, those for example by Benda, by Benecke and by Bostroem, enter fully into a discussion of the nature and origin of the lesions.

Since von Remak first expressed the opinion in 1854 that these growths were due to epithelial "rests," a number of different views have been advanced concerning them. In his original paper Virchow classified them as heterologous tumors arising in the connective tissue, and though it would appear that he regarded them as epithelial, he confused contemporary readers by likening them to cancroid. Several of his followers (Glaesser, Benecke, and others), attributed them to an endothelial anlage, an opinion which can only be explained on the basis that a variety of tumors with scant regard for their origin or histology, whether endothelial, epithelial, or otherwise, came to be called cholesteatomata after Mueller had coined the term, for the simple reason that they contained deposits of cholesterin crystals.

A familiar example of this is the so-called cholesteatoma of the choroid plexus which Klebs properly regarded as endothelial in origin. Though found also in man, they are far more familiar to comparative pathologists, and the only example I have seen was in the brain of a horse, the specimen having been given me by Professor Theobald Smith. These intraventricular tumors are in no sense comparable to those which we are considering, and Blumer's designation of them as "cholesteatomatous endotheliomata" is the proper one.[4]

Certain of the suprasellar cysts of pharyngeal (Rathke's pouch) origin offer another illustration of the misuse of the term. For cholesterin crystals are precipitated in the fluid contents of some of these cysts and though they unquestionably originate from epithelial "rests" dating from an early period of development, these inclusions are of pharyngeal rather than of cutaneous origin and have fluid contents in place of the fatty mass of desquamated cells of the cholesteatoma proper.[5]

All this merely shows how unsatisfactory the term cholesteatoma really is unless all are

[1] "Ueber den feineren Bau und die Formen der Krankhaften Geschwuelste." Berlin, 1838, i, Lief., 39-54. They were discussed by Mueller under the general title "*Von der geschichteten perlmutter glaenzenden Fettgeschwulst; Cholesteatoma*" and were regarded as a subgroup of fatty tumors which comprised (1) the lipomata, (2) the fat cysts, (3) cholesteatomata. He described as cholesteatomata, tumors elsewhere than in the cranium.

[2] Ueber Perlgeschwuelste. Arch. f. path. Anat., etc., Berl., 1855, viii, 369-416.

[3] Esmarch, Fr. Cholesteatoma im Stirnbein. Arch. f. path. Anat., etc., Berl., 1856, x, 307-316.

[4] G. Blumer. Bilateral cholesteatomatous endotheliomata of the choroid plexus. Johns Hopkins Hosp. Rep. (Welch Festschrift), 1900, ix, 279-290.

[5] There have been 28 surgically verified pharyngeal pouch (suprasellar) cysts in my tumor series, and in several of them cholesterin crystals were present. It should be said in this connection that the cyst wall of three of these tumors which were histologically examined by Bailey contained keratohyalin granules, which suggests a dermal origin (P. Bailey. Note concerning keratin and keratohyalin in tumors of the hypophyseal duct. Ann. Surg., 1921, lxxiv, 501-505). However, in only one of the 28 cases did the cyst in other respects resemble the traditional cholesteatomata.

agreed to restrict it to tumors of a given type and origin, or else to modify the term by indicating whether the growth is endothelial or epithelial in origin.

If we confine ourselves to the true epithelial cholesteatomata and to those originating in the the cranial chamber elsewhere than near the ear, they are found to represent only a fraction of one per cent of intracranial neoplasms as a whole. In my own series, consisting at the present writing of 740 histologically verified tumors, there have been, including the present case, only three examples, so that they represent less than half of one per cent of all tumors. This corresponds approximately with the figures given in the tumor series of Tooth, of Bernhardt, and of others.

Two of these cases have already been reported by Dr. Percival Bailey[1] as examples of Cruveilhier's "Tumeurs Perlées." The lesion in one of the patients apparently originated between the cerebellum and the roof of the fourth ventricle and gave a definite cerebellar syndrome. Dr. Bailey was able to find in the literature only eight similar cases, all of them having been postmortem findings. In the other patient the lesion was suprasellar, situated below and deforming the third ventricle.[2]

The characteristic, glistening, mother-of-pearl appearance of the surface of a cholesteatoma is seen at its best in the case of these median subarachnoid tumors which have no connection with the dura or bone. They are of most variable size and occasionally may attain such dimensions, reaching from chiasm to foramen magnum, that their meningeal point of origin cannot be determined.

At the time of Dr Bailey's report we had not seen any intracranial cholesteatomata other than those of the Cruveilhier type, but since then two examples of typical "pearly tumor" which, however, were hair-containing have been met with. It is evident, therefore, that these lesions, which beyond question are of cutaneous origin, may arise either from an epidermal or dermal implantation. This opinion coincides with that of Bostroem of Giessen, who in 1897 published one of the most thorough analyses of the subject. He reported two cases of his own, one a true *epidermal* cholesteatoma, and the other a hair-containing, or *dermal* cholesteatoma,[3] both of them arising from the leptomeninges.

It is important to bear in mind, therefore, that the intracranial cholesteatomata which show the characteristic mother-of-pearl surface may or may not be hair-containing, depending upon whether the original epithelial inclusion consisted of the malpighian layer alone, or of the whole skin. It would appear from my series that one variety is as common as the other.

From what has been said, it is evident that the more common situations of the so-called cholesteatomata are (1) in and about the temporal bone; (2) free in the leptomeninges of the cerebral base; (3) in the cerebral ventricles, these last being endothelial tumors.

In still another situation, typical cholesteatomata may occur, namely in the bones of the skull at places remote from the middle ear. Under these circumstances, as is also true of the tumors encountered by the aurist in the temporal bone, the glistening surface of the growth is obscured by its environment. Nevertheless, its characteristics, gross and microscopic, are otherwise the same as in the leptomeningeal tumors. These growths, judging from the few cases which have been reported, appear to be of the epidermoid variety alone. They seem to originate between the two tables of the skull, the inner table being the first to become ballooned out and absorbed as the growth enlarges. Such a tumor is represented by the lesion found in the following case.

CASE REPORT

P.B.B.H. Surgical No. 13649. *December 7, 1920.* Admission of Mr. ——, an army officer, age 40, an alert, active individual with the complaint of slight dragging of his left foot.

Family history. Excellent, except that his mother died from malignant disease.

[1] Bailey, P. Surg., Gynec. & Obst., 1920, xxi, 390-401.

[2] Since writing this note, there has been another epidermal cholesteatoma exactly like the first of the cases which Dr. Bailey described. The tumor occupied the roof of the fourth ventricle, distending the iter and producing hydrocephalus. This makes a percentage of approximately one half of one per cent for these lesions, or one per cent if the dermal as well as the epidermal cholesteatomata are taken together. It is quite possible that a good many of these tumors may be overlooked in an ordinary cerebellar exploration. The tumor in this last case was disclosed by accident, on pulling up the cerebellar tonsils which had herniated into the spinal canal, after a thorough exploration of the posterior fossa in and around the cerebellum had been regarded as negative.

[3] Bostroem. Ueber die pialen Epidermoide, Dermoide und Lipome, und duralen Dermoide. Centralbl. f. allg. Path. u. path. Anat., 1897, viii, 1-98.

Past history. Always strong and vigorous with good habits. Graduate of a military academy in 1898, where he stood above the average in his class. Diphtheria in 1908. A glancing bullet wound of occipital region in 1910. Tropical dysentery in 1915. A fall from a horse in 1916 with some transient concussion. A hæmorrhoid operation in 1918. All his life he had had a slight impediment of speech in the nature of a lisp.

Present illness. It was somewhat difficult to know when this began, if indeed his symptoms may be called an illness. He was inclined to date his troubles to the fall from his saddle which occurred in *March, 1916*, at which time he struck his head and was stunned for a few minutes, but was otherwise not inconvenienced nor was his work interrupted. There was no contusion of the scalp.

Four months later (July) he happened to observe that there was a small depression in the left temporoparietal region which was slightly sore on pressure. This slight defect or indentation in the skull, naturally attributed to his fall, has slightly increased until it now will almost take the tip of the little finger. *In September, 1916*, when ordered up for promotion, note was made of this condition by the examining surgeon. During 1917 he was busy organizing a regiment. Apparently he did not always agree with the opinions of his superiors and consequently was regarded as being eccentric.

In *May, 1918*, he was ordered before an examining board. At this time an X-ray was taken of the skull which revealed the same curious appearance to be described as present 2 years later. He passed all physical and mental tests without difficulty and in *July, 1918*, was sent to France. After 3 months' hard work overseas he became much run down. He was examined and was said to have a psychoneurosis. Consequently he was relieved from duty, sent to a hospital, and invalided home.

In *November, 1918*, another X-ray was taken which showed the peculiar defect in the cranial bones to be unchanged. A war-made neuropsychiatrist found him "hyper-active" and he was given 3 months' leave. He reported before the expiration of this time, was re-examined, again successfully passed all mental and physical tests above the average, and was returned to duty.

For the next 18 months he was in active service on the Mexican border but did not stand the heat well during the summer and again became run down. At this time he was reclassified and put in Class B by a board of officers but he successfully fought the action of the board and was reinstated.

In *September, 1920*, for the first time he had some discomforts—vague pains in the back of his neck. He was again examined, and found to have some weakness in his *left* hand and a slight drag of his *left* foot. A diagnosis was made of "paresis with osteoporosis." Three spinal punctures were performed, but tests of the fluid were negative. A month later he was ordered up for another neuropsychiatric examination and the diagnosis of "paresis" was confirmed and he was recommended for retirement.

For the past month there has been for the first time a slight sense of soreness or discomfort in the region of the cranial defect and he has detected a slight pulsation there.

These are perhaps the essentials of the long story, told by the patient with a most unusual preciseness and clearness of memory for dates and incidents. The general physical and special neurological examinations, with the exception of two things, were absolutely negative. These were (1) the cranial lesion disclosed by the X-ray over the left hemisphere, mentioned in the history as having been first observed 2 years before, and (2) the slight neuromuscular disturbance on the same —the *left*—side of the body. He is right-handed.

There was otherwise nothing. Fields of vision, eye grounds, ears, hearing, body fluids—all were normal. In view of the history, interest naturally centered on the patient's mentality, but so far as could be determined there was nothing which could be regarded as abnormal. A man of strong personality, of active mind, alert, perhaps somewhat impatient, opinionated and aggressive, he apparently had not always suited his possibly more phlegmatic superiors who regarded him as prone to assume responsibilities before they were allotted to him. These traits appear to have occasionally made trouble for him and to have aroused the enmity of certain fellow officers.

He had, as stated, an exceptionally accurate and retentive memory; he was co-operative, interested, made friends easily—in short, showed no stigmata of mental deterioration or variation from the normal, other than what personality might account for. He was inquisitive about his condition rather than introspective and was not at all neurasthenic.

I. The changes in the skull. (Fig 1.) The X-ray showed an extraordinary quadrilateral area of bone absorption over the left side of the skull, measuring about 3.5 inches on each side, resembling on the plate the appearance which might have been left by an old craniectomy. The somewhat irregular and wavy outlines of the defect were sharply demarcated

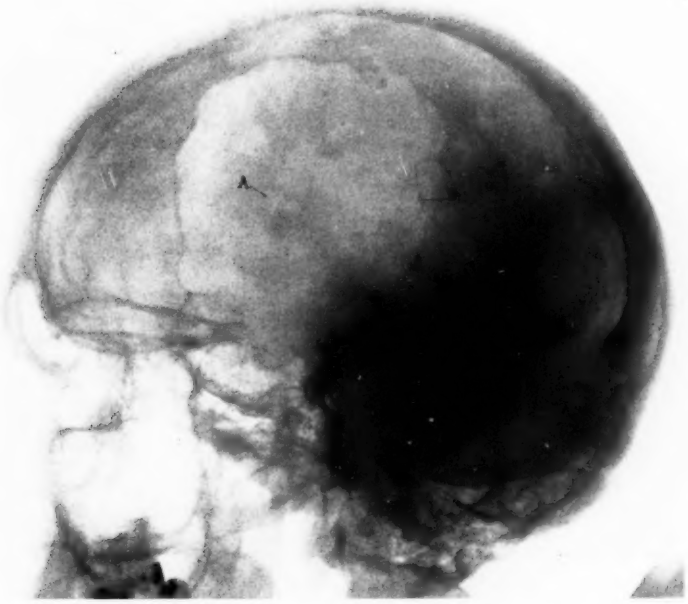


Fig. 1. Roentgenogram of left cranium (reduced one-half) showing bone defect. Point of complete absorption at *a*. Scale of bone at *b* from inner table, shown by stereoscope to be on edge and well within cranial chamber.

and the area showed irregular patches where the bone had undergone almost complete absorption. In the center was a small trifolate patch corresponding to the tender spot near the temporoparietal suture, where palpation revealed a defect in which there was slight pulsation (Fig. 1. a). The external surface of the skull appeared otherwise to be normal. Stereoscopic studies showed that the sharply cut margin of the defect had a raised border projecting slightly within the chamber; also that there was a thin, isolated scale of bone corresponding to the posterior border of the lesion which stood away from the bone defect perpendicular to the surface and well within the cranial chamber (Fig. 1, b).

This appearance could only be explained on the ground that there was a large growth of some kind within the skull, but how a lesion of such a size, in this situation over the left hemisphere, could have produced such a degree of pressure atrophy of the bone without some evidence at the same time of cerebral involvement was inexplicable. A lumbar puncture needle was inserted through the small bone defect without finding fluid. In its lumen on withdrawal was a little yellowish material which, under the microscope, resembled degenerated epithelial cells.

2. *The positive neurological findings.* The slight weakness and awkwardness of the left foot of which the patient complained really amounted to little, but the deep reflexes on the left side were unquestionably more brisk than the right. Occasionally an ankle clonus was elicited on this side, though never a positive dorsal toe response, the character of the left plantar reflex being somewhat obscure.

These symptoms, homolateral to the cranial defect, were a source of confusion before the operation, nor can they even now be satisfactorily explained. Suffice it to say they disappeared immediately afterward.

There were two considerations which made it difficult to decide just what, if anything, should be done in the way of an intracranial

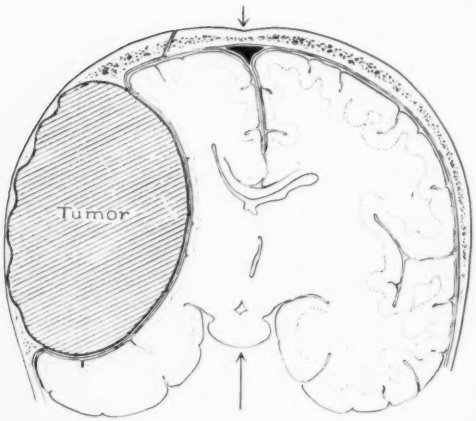


Fig. 3. Drawing to scale, representing on coronal section the position of the tumor within the skull. (Reduced one-half).

exploration. In the first place, was there, in addition to the obvious lesion over the left hemisphere, actually a process of some sort in the upper part of the right hemisphere responsible for his left-sided symptoms and increased reflexes? In the second place, was there actually a lesion demanding surgical measures on the left side, in view of the absence of contralateral symptoms, and, if so, how could it be safely explored without breaking into the area where the skull was greatly thinned? It was finally decided to outline and reflect an osteoplastic flap with a sufficient margin beyond the defect, to avoid, if possible, breaking into it. It was felt that, if a large tumor or cyst capable of enucleation should actually be disclosed, a most unsightly depression would be left if, in the process of its exposure, the egg-shell area of bone should happen to be damaged.

December 14, 1920. Operation. Osteoplastic resection. Disclosure of large cholesteatoma. Separation of tumor from dura and skull. Complete enucleation. Opening of dura with separation of adhesions. Closure without drainage.

A flap was outlined so as to allow for a half-inch of normal bone beyond the defect. Six to eight perforations were made but there was a good deal of difficulty in connecting them, owing to unusual bleeding from the diploe as well as from the numerous Pacchionian bodies projecting into the skull.

The bone incision was finally completed and the flap was tilted upward slightly, care being taken in this manœuvre that it should fracture well down in the temporal region. On looking under the slightly raised margin of the flap one could see that the dura was pulled up and was slightly adherent to the surface of a tumor. It was possible by careful dissection to separate from the tumor what proved to be an exceedingly thin dural membrane, there being a second membrane which remained adherent to the tumor. The thin dural membrane was brushed away from the surface of the tumor as the bone flap was slowly elevated, carrying the tumor with it (Fig. 2, frontispiece). On the inner surface of the growth between it and the dura were encountered a few thin flakes of distended inner table, in addition to the chief fragment on the posterior side which had been disclosed by the X-ray.

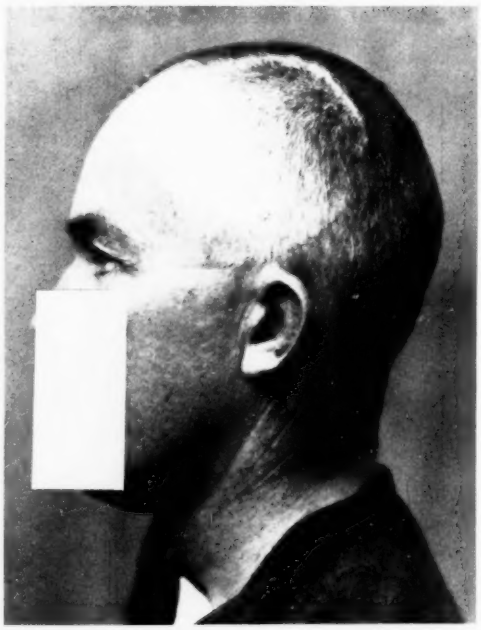


Fig. 4. Photograph of patient on discharge: to show situation of flap.

The tumor proved to be of unexpectedly large size, and at a late stage of the elevation of the bone flap the heavy growth began to sag away from its insecure attachment to the bone, so that the whole mass, together with the flap, was held up by a gauze hammock. The flap, together with the tumor, was finally lifted up intact from its pocket in the hemisphere covered now by the sagging dura.

The growth was very loosely attached to the irregular shallow cup it had made for itself in the bone and was separated without difficulty, though during this process the surface of the friable lesion was somewhat fragmented. The outer margin of

Fig. 5. The tumor mass (natural size).

the cup in which it lay consisted of a sharp ridge of bone which projected a few millimeters on to the side of the tumor in its entire circumference, accounting for the distinct peripheral shadow in the X-ray. This ridge was subsequently rongeured away so as not to leave a projecting edge on the under surface of the skull.

The portion of the flap corresponding to the area of absorption was very carefully cleared of all tags of tumor membrane, which being but slightly adherent were easily wiped away. The under surface of the bone showed a very much greater degree of absorption than had been anticipated in view of the X-ray findings, there being several irregular areas where no bone whatsoever remained, but merely a dense membrane.

A small opening was made in the thin, collapsed dura with the intent of floating it up by the injection of salt solution. This procedure revealed the fact that in the central portion of the exposed field there was an adhesion between dura and brain. Consequently the membrane was incised, disclosing a non-pulsating hemisphere which showed a concave depression of amazing dimensions. It was found that the centrally placed adhesion was a vascular one, there being a large vein and two small arteries uniting dura and brain. They were divided between clips: the membrane thus freed was closed and floated up with salt solution. The bone flap was replaced and closed in layers without drainage. A schematic representation showing the size and position of the growth on coronal section is given in Figure 3.

Recovery was uneventful. The wound healed perfectly (Fig. 4). The symptoms referable to the left side promptly disappeared and were possibly due to some distant effect of the growth difficult to explain. The patient was discharged *January 3, 1921*, and has remained well. So far as can be told at this writing, a year later, there has been no change whatsoever in his personality.

Pathological note. The tumor (Fig. 5) is a large, roundish mass the size of an adult fist. Its weight is

Fig. 6. Cholesterin crystals and fatty cellular mass from cyst contents.

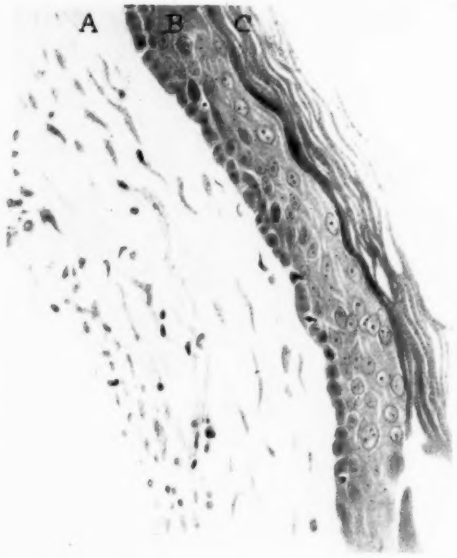


Fig. 7. Section of cyst wall (× 250) showing (a) the fibrous zone, (b) the zone of epidermal cells, and (c) lamellæ of desquamated epithelium.

175 grams and its measurement about 4 inches in diameter. Attached to its inner surface is a thin, fibrous membrane resembling a pseudo-dura. On removing this, the tumor proper shows the glistening pearly surface of a cholesteatoma, though less perfect than in the case of tumors which lie freely in the cranial chamber. The outer surface of the growth, which lay against the bone, has been somewhat fragmented in removal and the scale-like masses of desquamated fatty epidermis are somewhat broken apart.

Histological note. Between the friable lamellæ of fatty degenerated cells arranged more or less concentrically and constituting the central portion of the growth, cholesterin crystals are present in great numbers (Fig. 6). The thin membranous capsule of the tumor consists of an outer delicate zone of vascularized fibrous tissue, whereas the inner zone is made up of four to five layers of polygonal epidermoid cells with normal staining reactions. (Fig. 7). Keratohyalin granules are demonstrable but no eleidin granules are found. The capsule appears to contain no papillæ, nor are hairs present in the central mass.

As previously stated, the cholesteatomata arising from the leptomeninges have usually been unexpected postmortem findings, and most of the treatises which deal with them have been presented by pathologists. Their surgical aspects have rarely been considered. Tooth's report[1] of the 500 cases of tumor observed at the National Hospital in Queen's Square gives two examples which had been operated upon by Sir Victor Horsley. Both of them were extracerebellar tumors occupying the lateral recess on the right side, and they possibly may have been connected with the temporal bone. The histological study of the lesion was inconclusive, for the tumor mass in both cases was incompletely removed with a spoon and the lining membrane not secured.

On the other hand, the extradural cholesteatomata, which seemingly arise from between the tables of the bones of the skull as in the case here reported, have not infrequently been subjected to operation, and with the exception of the early reference to an occipital cholesteatoma by Johannes Mueller, the few cases in the literature seem to have been reported by surgeons. The operations have not been particularly satisfactory ones, as the tumor mass has usually been entered through

[1] Tooth, Howard. The treatment of tumors of the brain and the indication for operation. Tr. XVII Internat. Cong. Med., 1913, Sect 11, 161-257 (Cases 244-245).

the bone defect and the complete eradication of its lining membrane has been rendered thereby well-nigh impossible. Though a more extensive search might reveal additional case reports, those of which I am cognizant are as follows:

1. *Esmarch's frontal case.*[1] A fluctuating, slowly growing tumor of hen's-egg size in the left frontal region of a man, age 24, present for 14 years. Both tables had become completely absorbed and the tumor was surrounded by a sharp bony edge and presumably originated in the diploe. The tumor was operated upon. Fragments of its inner membrane were incompletely separated from the dura. The cavity was packed. Recovery.

2. *Weinlechner's frontal case.*[2] A man of 45 who had received a blow on the forehead at 8 years of age. A tumor developed, producing epilepsy. Two operations were performed; the first was followed by suppuration. The tumor had led to a small area of pressure absorption of the outer table and extensive absorption of the greatly distended inner table. Drainage; recovery.

3. *Wotruba's frontal case.*[3] A man, age 22, with a right frontal tumor of goose-egg size deforming the right eye and causing severe headaches. The overlying bone had become absorbed and at the base of the large tumor cavity the internal table was likewise largely absorbed. The cholesteatomatous mass was scooped out through the defect but the inner membrane adhering to the dura could only be removed in fragments. Drainage; recovery.

4. *Blecher's frontal case.*[4] A 24-year-old workman had, as a child, received a blow on the left side of the head in the parietal region. A local swelling developed, which in time enlarged to the size of a hen's egg and became soft and fluctuating. It was demarkated by a sharp bony edge. It produced headaches. There was no pulsation. At the operation the central mass was scooped out, leaving a large cavity lined with a bluish-white skin which, by pincers and curette, could only be incompletely removed piecemeal from its attachments to the dura. Recovery.

5. *Borchardt's occipital case.*[5] A 46-year-old workman had received a trifling scalp wound in the occiput. Headaches followed, and shortly after a palpable defect was observed in the occipital bones. It was tender but without pulsation. It produced general pressure symptoms with choked disc and a cerebellar localizing syndrome. Operation revealed a large extradural cholesteatoma weighing 90 grams.

6. *Koerner's occipital case.*[6] A man of 41 had for years suffered from suboccipital headaches. A semi-fluctuating swelling developed low in the left side of the occiput in which one could feel the margin of a bone defect. Operation revealed a large cholesteatoma whose contents were scooped out. Recovery.

These few cases abstracted here, including my own, show three frontal, two parietal, and, with Mueller's case, three of the occipital region. There are a few other cases referred to in the literature, the original reports of which have not been identified. Such for example is Pfannenmueller's case mentioned by Bergman as occurring in the temporal region[7], and also Benda's cerebellar case reported in 1897 before the Berlin Medical Society.

These cases constitute a group of true epidermal cholesteatomata which are extradural and appear to originate between the two tables of the skull. The tables become separated, thinned by pressure, and finally absorbed, the inner table as a rule suffering more than the outer. In all former instances the cystic mass has been intentionally opened early in the operation and, as Blecher remarks, the extirpation of the growth *in toto* is impossible under these circumstances owing to the fact that the membrane adheres to bone and dura, which makes a recurrence probable. Unquestionably the removal of the epidermal membrane is the crux of the procedure and this can only be accomplished before the cyst is emptied of its contents and its enveloping membrane permitted to collapse. Incomplete removal of the lining wall is doubtless the explanation of the recurrences so common after operations by otologists for the cholesteatomata of the temporal bone which come almost solely into their province.

To summarize: It may be said that the cholesteatomata or pearly tumors proper arise from epithelial implantations which occur in the development of the embryo. They are seen in their most typical form in the leptomeninges, more commonly between the cerebellum overlying the fourth ventricle, and in the infundibular region. They also occur in the cerebellopontile recess, and in the Sylvian

[1] Loc. cit. 1856.

[2] Reported at a session of the K. K. Gesellschaft der Aerzte in Wien. Wien. klin. Wchnschr., 1889, Feb. 14, No. 7, p. 136.

[3] Ueber ein Cholesteatom im Stirnbein. Wien. klin. Wchnschr. 1889, Nov. 21, p. 889.

[4] Ueber Cholesteatome (Epidermoide) der Schaedelknochen. Deutsche Zschr. f. Chir., 1903, lxx, 352-362.

[5] Cholesteatom der hinteren Schaedelgrube. Arch. f. klin. Chir., 1905, lxxvii, 892-899.

[6] Ein Cholesteatoma verum in der hinteren Schaedelgrube. Ztschr. f. Ohrenheilk., 1900, xxxvii, 352.

[7] Pfannenmueller: Inaugural Dissertation. Giessen, 1896 (not verified).

cleft. These epithelial implantations may be either epidermoid or dermoid. Hair-containing tumors when arising in the leptomeninges may have all the external characteristics of the typical pearly tumor of Cruveilhier.

The epidermal cholesteatomata, relatively common in the petrous and mastoid portions of the temporal bone, are in all probability of the same nature, for precisely similar tumors may be found elsewhere in the skull, over frontal, parietal, and occipital regions distant from the temporal bone. As the inner table of the skull becomes absorbed, these tumors though remaining extradural, may attain a large size and come to deform the brain greatly.

They are capable of recognition by the X-ray owing to the associated bone defect, and are capable also of complete surgical removal if approached by a flank rather than direct attack in order that the epidermal membrane may be peeled from the dura. This desideratum is hardly possible if the central mass is primarily opened through the defect, thereby permitting the delicate lining membrane of the sac to collapse.

THE PRESENT STATUS OF OPERATIVE OBSTETRICS REFERRING TO THE ABUSE OF CÆSAREAN SECTION[1]

By JOHN OSBORN POLAK, M.Sc., M.D., F.A.C.S., and A. C. BECK, M.D., Brooklyn

THE operative furor has surely invaded obstetrics, when even the physiological processes of normal labor are disturbed, and a normal sized child, in normal position, passing by a normal mechanism through an ample pelvis, with dilatable soft parts, is interfered with; the head disengaged, a version done and delivery accomplished by breech extraction on the plea that the woman is saved an hour or two of second-stage pains.

Other enthusiasts, either for their own convenience or to save the woman an hour or so of suffering, are routinely applying forceps when the head has reached the ischial spines, and the cervix is fully dilated; while others have so widened the indications for cæsarean section that this operation is being employed daily on patients who present no real obstetric indication for it, simply because it is the most convenient way to get the baby out.

It is the purpose of this brief paper first to review the present status of operative obstetrics, and to show that there is a difference between surgical obstetrics and obstetric surgery done for justifiable indications; second, that routine operative intervention, even in the hands of the expert, is not free from danger to both mother and child; and finally that while cæsarean section is the easiest and quickest method of delivery, there is a higher *morbidity* and a higher *mortality* following abdominal hysterotomy, than follows abdominal section generally in properly selected cases.

First, let us study the operative incidence in a series of a thousand consecutive cases, which have had intelligent and painstaking prenatal study—where each labor is conducted with a full knowledge of existing conditions, on the principle of aseptic intelligent expectancy, and where intervention is done, not withheld, on proper indications, solely in the interest of the mother or the child—and then let us compare these with 1,113 cases delivered by one man, an acknowledged expert, who has deliberately interfered with the normal processes of labor as a routine procedure.

In this series of a thousand cases there were 106 patients with actual contraction of the pelvis, an incidence of 10.6 per cent, 344 in which the occiput was posterior at the beginning of labor, and 42 cases in which the presentation was abnormal. These included 27 breeches—6 face or brow, 4 transverse, 4 sets of twins, and one complex presentation with

[1] Read before the Clinical Congress of American College of Surgeons, Philadelphia, October 26, 1921.

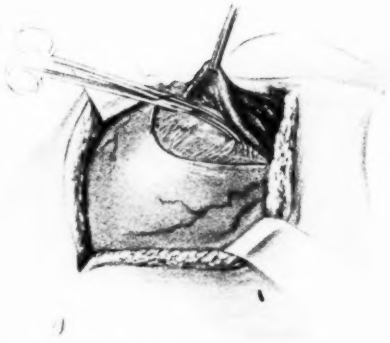


Fig. 1. Modified Kroenig cervical cæsarean section. Separation of bladder from anterior face of uterus.

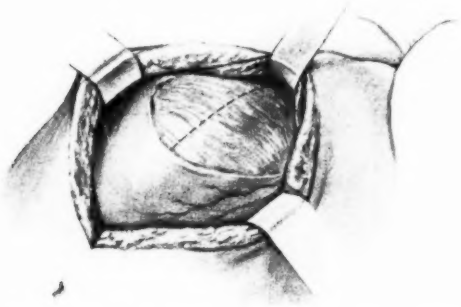


Fig. 2. Modified Kroenig cervical cæsarean section. Bladder retracted, area for incision exposed.

the head and cord presenting; yet in this series the incidence of operative intervention was as follows:

Forceps deliveries—low and median	22
Version—internal or bipolar	5
Induction of labor—by bag	4
Manual conversion of face into a vertex	2
Perforation of the after-coming head	1
Cleidotomy	1
Cæsarean section	8

This gives an incidence of forceps of 2.2 per cent, an incidence of version of 0.5 per cent, and an incidence of cæsarean section of 0.8 per cent. The number of stillbirths in this series was 19 or 1.9 per cent; including all of the infants dying within the first 2 weeks after delivery—6 more deaths should be added, making a total infant mortality of 25 in a thousand cases, or 2.5 per cent.

Compare these statistics with those published in the *transactions of the Association of Obstetricians, Gynecologists and Abdominal Surgeons* for 1920, by one of the most skillful surgical obstetricians in America.

During the year ending August 31, 1920, he personally delivered 1,113 women on whom he performed 920 versions, 39 forceps operations, and 80 cæsarean sections; or approximately one cæsarean in every 14 cases—10 women were so far advanced in labor when they were first seen that they could not be prevented from delivering spontaneously, and 12 babies were born before the attendant reached them. In this series 41 were stillborn, and 34 died before the mother was discharged from the hospital; making a total fœtal mortality of 75, or 6.7 per cent, or nearly three times the mortality rate of the infants of the previous series referred to. Such facts leave no room for argument, they clearly demonstrate the contention that I made at the beginning of this paper, namely, that routine operative intervention even in the hands of the expert, is not free from danger to both the mother and the child.

Operative obstetrics no longer recognizes the induction of premature labor in contracted pelves, for it is admitted that induction is not free from danger; the increased danger of infection is actual, not fanciful, and complications as premature rupture of the membranes, malpositions of the fœtus, prolapse of the hand or cord do occur. Furthermore, operative intervention is required to terminate labor in a very large number of the cases (54 per cent of bag cases); this necessarily subjects the child to greater danger, not only because of its prematurity, but because it is subjected to unnecessary manipulation.

Present-day obstetric teaching recognizes the propriety of giving each case an aseptic test of labor when the pelvic deformity falls within the relative class, for over 80 per cent of these cases (8 out of 10) spontaneously deliver; or can be terminated after the head has reached the spines, by low forceps.

High forceps is an operation of history, its high fœtal mortality, and the frequent incidence of severe maternal injuries have

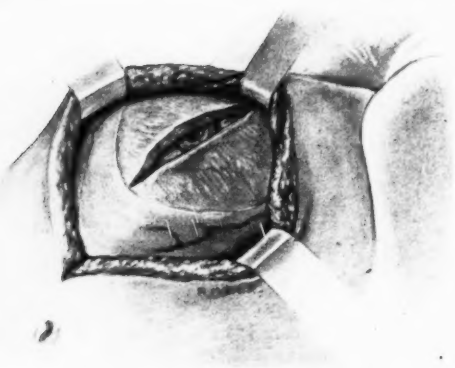


Fig. 3. Modified Kroenig cervical cæsarean section. Showing the location of the incision in the lower uterine segment.

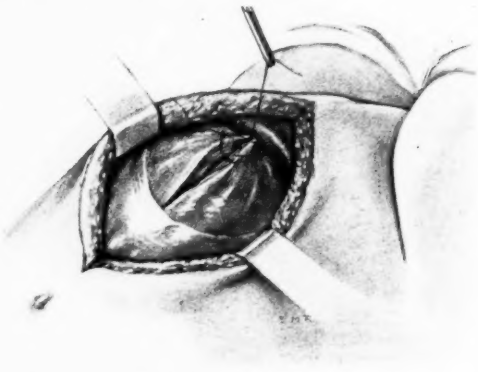


Fig. 4. Modified Kroenig cervical cæsarean section. Closing the uterine incision with a running suture of the muscle.

caused the procedure to be relegated to the atrocities of the past. On the other hand, low forceps applied with the head at or below the spines, is an operation which, when indicated, is purely life saving.

Proper attention to the action, rhythm, and rate of the fœtal heart after the membranes have ruptured and the head has passed through the cervix into the vagina, will give notice to the observing accoucher as to when a low forceps delivery should be employed, for many children lose their lives as the result of too conservative a delay during the perineal stage.

Low forceps applied under surgical anæsthesia, with the patient in the proper posture, does little or no damage to the pelvic soft parts (in the hands of a competent man).

Version according to the technique perfected and so ably described by Potter, has a wider field than has been generally given it, *but not as an elective routine procedure in normal cases.* While the majority of occipito-posterior positions of the vertex, will spontaneously rotate to the front, if the head engages and reaches the pelvic floor, and the powers are sufficient (possibly without increasing the risk). This tedious mechanism may many times be avoided by a timely version. Version, however, has its widest indication as an emergency procedure in complex presentations —brow, face, and the accidents such as prolapsed cord, placenta prævia, abruptio placentæ where rapid delivery is demanded in the interest of the child.

In present day obstetrics, embryotomy has but a limited field, and is now practically never done on the living child except in the presence of an infected mother, and even here, the Porro operation may come into competition, if there is strong necessity of delivering a living child. On the other hand, perforation cleidotomy and evisceration should have a more general use in terminating the delivery of the dead fœtus.

CÆSAREAN SECTION—ITS ABUSES

There seems to be a fallacious impression in the minds of both the general medical and lay public, that cæsarean section is a perfectly safe and simple operation which can always be guaranteed to give perfect results under all circumstances. They evidently forget the fact that *abdominal surgery always carries with it a certain risk to the life of the patient* even in the most competent hands and under the best conditions. Hence, instead of being chosen as the operation of election after careful consideration, because it is the safest and best method of delivery for the patient, cæsarean section is looked upon by many poorly trained obstetricians and general surgeons who do consultation obstetrics even though they do not pretend to have a working knowledge of fundamental principles of the obstetric art as a panacea for all ob-

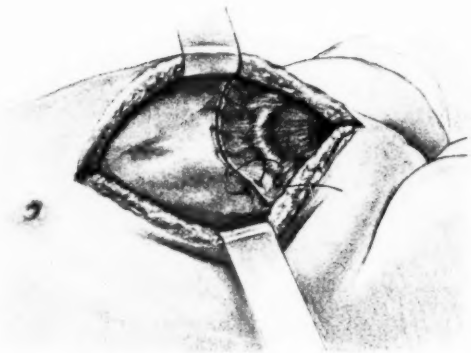


Fig. 5. Modified Kroenig cervical cæsarean section. Uterine incision in the lower segment covered with bladder reflection. Sutures being placed.

stetric ills—presumably the ease with which the operation can be performed by the average abdominal surgeon is the prime factor in the choice of suprapubic delivery in improper cases; for as compared with the ordinary obstetric operation, except perhaps an easy low forceps, cæsarean is the easiest method of delivery for the obstetrician, and the safest operation for the child.

Notwithstanding this general impression, our study of the results in 2,200 operations of which 200 are from our own clinic shows that cæsarean has a *greater morbidity and mortality than the ordinary abdominal operation* done for other pelvic conditions.

The development of the aseptic technique in surgery has made it possible to consider the rights of the child as well as the rights of the mother; hence in modern obstetrics, abdominal hysterotomy done under proper conditions by a competent operator, has been used in the interest of the child as an elective procedure in preference to some of the mutilating operations.

It may be performed as an operation of election, when a thorough examination demonstrates the fact that the child will be subjected to serious danger, in case an attempt is made at pelvic delivery, or that the health of the mother is likely to suffer seriously as a result of such a pelvic delivery. These conditions warrant the somewhat increased risk that attends an abdominal operation.

Fig. 6. Classical cæsarean section. Showing how the assistant crowds the uterus into the abdominal incision by pushing the uterus upward and forward with the hands on the sides of the abdomen.

Study of the end-results shows that those obtained by cæsarean section performed at the time of election, that is before labor begins or early in the course of labor, are much better than the results of the late or secondary operation. This therefore, *implies the necessity of very careful prenatal study, the proper estimation of the relative size of the child to the particular pelvis and the aseptic conduct of the labor*, so that if the operation is indicated it may be performed at a time when the best results may be expected for both patients.

Unfortunately, in general practice, prenatal study receives very little consideration, and most labors are conducted with questionable asepsis and repeated vaginal examinations. It is common knowledge that the majority of pregnant women are allowed to enter upon labor without any preliminary examination; the attendant having no accurate knowledge of the relative size of the pelvis or fœtus, or of the position of the fœtus; hence section is done not as an operation of election, but as an operation of the last resort, often after

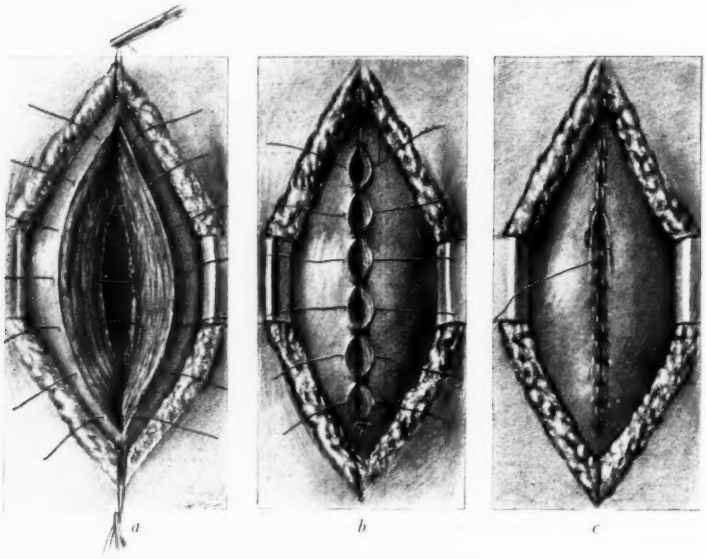


Fig. 6. *a*, Wound brought into the incision (abdominal) by traction sutures, interrupted sutures through peritoneum and muscle, just skipping endometrium, placed. *b*, Deep layer tied. Second line between each deep suture placed. *c*, Final peritonealization of uterine wound with running suture.

the patient has been subjected to repeated vaginal examinations which always open an avenue for infection; or after attempts have been made at infrapelvic delivery. These cases are potentially infected and, therefore, when section is done it is attended with a morbidity or mortality higher than should be present in properly selected abdominal cases.

Several operators can show a series of 100 or more consecutive sections without a fatality; but from a study of several thousand case reports where the operation was done by the best operators, we feel certain that their mortality will come as it has come to others.

While these surgical obstetricians have widened the indications for the use of this procedure, so that they include almost every conceivable difficulty, the obstetric surgeon is limiting the indications in both his practice and his teaching, placing its election on well-grounded indications.

Broadly speaking, the indications for abdominal delivery may be classed as those that are absolute and those that are relative. Cæsarean section is indicated in the patient in whom some definite pelvic obstruction exists either as a result of actual contraction, or by the presence of tumors blocking the pelvis which renders delivery *per vaginam* even of a dead or mutilated fœtus either impossible or so dangerous that abdominal delivery is attended by less risk to the mother.

A contracted pelvis with a true conjugate of 6 or 6½ centimeters or an immense child will give the absolute indication. This is admitted to be the only absolute indication for operation, and any operator who performs cæsarean for other reasons must be sure that the benefits which are to be expected from the operation both for the mother or the child are sufficient to warrent the increased risk to the mother's life.

In the relatively contracted pelvis, cæsarean is considered only with a view of saving the life of the child, for in dystocia from this cause embryotomy may safely deliver from below. This leads us to the one question that should always be considered: *is it proper to*

TABLE I.—TABULATED STUDY OF TWO THOUSAND CASES OF CÆSAREAN SECTION FROM REPORTS OF OBSTETRIC CLINICS IN AMERICA, EXCLUSIVE OF LONG ISLAND COLLEGE HOSPITAL

Group I—Clean Cases	
Sections	210
Maternal deaths	6
Mortality percentage	2.9
Group II—Potentially Infected Cases	
Sections	1260
Maternal deaths	78
Mortality percentage	6.2
Group III—Frankly Infected Cases	
Sections	530
Maternal deaths	61
Mortality percentage	11.5

TABLE II.—AN ANALYTICAL STUDY OF TWO HUNDRED CASES OF CÆSAREAN SECTION OCCURRING IN THE MATERNITY SERVICE OF THE LONG ISLAND COLLEGE HOSPITAL, FROM SEPTEMBER 1, 1912, TO SEPTEMBER 1, 1921

These cases were reviewed with reference to the following points, and the subjoined tables based on the results of this study.

1. Seen in the hospital before labor		
2. Referred from outside physicians		
3. Membranes	(a) Intact	
	(b) Hours ruptured	
4. Vaginal examinations		
5. Total number made	In hospital	
	By physician	
	By midwife	
	On the outside	
6. Number of hours in labor		
7. Type of operation	(a) Classical	
	(b) Transperitoneal	
	(c) Porro-Supracervical hysterectomy	
8. Diagnosis	Condition demanding cæsarean	
9. Puerperium	Highest temperature	
	Day postpartum on which it occurred	
	Number of days above 100.4°	
	Febrile—classes as febrile when temperature was 100.4° or more for 96 hours	
	Cause of morbidity	
10. Condition on discharge		

TABLE III.—THE EFFECT OF VAGINAL EXAMINATIONS ON MORBIDITY

No vaginal examinations, labor being conducted by abdominal and rectal palpation	
Total cases	97
Febrile cases	28
Morbidity	28.8 per cent
Vaginal examinations were made	
Total cases	96
Febrile cases	50
Morbidity	52 per cent

These have again been divided into those in which all of the vaginal examinations were made in the hospital under strict aseptic precautions and those in which the vagina was invaded on the outside prior to admission.

Vaginal examinations in the hospital	
Total cases	65
Febrile cases	27
Morbidity	41.5 per cent
Vaginal examinations on the outside prior to admission	
Total cases	31
Febrile cases	23
Morbidity	74.2 per cent

TABLE IV.—THE EFFECT OF RUPTURE OF THE MEMBRANES ON MORBIDITY

	Not ruptured	Ruptured
Total cases	106	87
Febrile cases	34	44
Morbidity percentage	32	50.5

TABLE V.—EFFECT OF HOURS IN LABOR ON MORBIDITY

Operated on early in labor	
Total cases	83
Febrile cases	26
Morbidity percentage	31.3
Operated on late in labor	
Total cases	110
Febrile cases	52
Morbidity percentage	45.4

add that increased risk to the woman in order to save the child.

My own feeling is that the healthy unborn child has equal rights with the mother, provided she is not potentially infected, yet we cannot blind ourselves to the fact that the woman is assuming an increased risk when she agrees to abdominal delivery.

The further admitted indications may be stated as follows: Labors in multiparæ who have had previous obstetric disasters may be terminated by section, unless the present child is manifestly smaller than the previous children have been or the previous disaster can be traced to the faulty judgment or poor operative skill of the former attendant.

Placenta prævia as an indication for abdominal delivery has its advocates. We teach and practice it, when the patient is at or near term, in good condition and has not been subjected to vaginal invasion with a live child and a central or nearly total implantation of the placenta. Unfortunately these conditions rarely obtain, for the average patient with central placenta prævia has usually lost considerable blood and has had careless and unaseptic measures used for the control of bleeding, so is potentially or actually infected and is necessarily a bad operative risk.

Since Petersons' exhaustive paper on cæsarean in *eclampsia*, the operation has been frequently used to empty the uterus in eclampsia, while we occasionally employ it in the pre-eclamptic toxæmia, when eliminative treatment has failed to relieve the toxic symptoms and the obstetric conditions either in the bones or soft parts make infrapelvic delivery difficult and dangerous.

We cannot, in the light of present day statistics and the results obtained from the Stroganoff treatment, feel that abdominal delivery saves many more lives.

Abruptio placentæ is a proper, though rare indication, and then only when the birth passages are totally unprepared. In addition to these, the indication for section has been extended to breech presentation with large

TABLE VI. MATERNAL MORTALITY

Causes of death	
Peritonitis and septicæmia	8
Hæmorrhage	2
Eclampsia	4
Postoperative shock	1
Postoperative pneumonia	1
Total deaths	16
Mortality percentage	8

16 deaths in 200 cases.

If we deduct the four deaths due to eclampsia there were 12 deaths in 196 operations or a mortality of 6.1 per cent.

TABLE VII.—ANALYSIS OF MORTALITY IN CLEAN CASES AND IN THE POTENTIALLY OR FRANKLY INFECTED CASES

Clean cases conducted in the hospital in which only rectal examinations were made or where a vaginal examination was done, surgical asepsis was observed.	
Total cases so conducted	148
Deaths	6
Mortality percentage	3.3
Potentially or frankly infected cases which had been handled on the outside prior to admission to the hospital	
Total cases	48
Deaths	7
Mortality percentage	14.6
All cases of both classes	196
Deaths	12
Mortality percentage	6.1

TABLE VIII.—STILLBIRTHS

Stillbirths in 200 cæsarean operations	2 or 1 per cent.
Infant deaths in the first 14 days	9 or 4.5 per cent.
Cause of infant deaths	
Died 1st day after delivery—maternal emergency prematurity	2
Died first 8 hours after delivery—toxæmia prematurity	1
Died 6 hours after delivery—toxæmia prematurity	2
Died 1 hour after delivery—prematurity	1
Died 10 hours after delivery from rupture of the lung result of mouth-to-mouth insufflation	1
Died 5 days after delivery—bacteræmia	1
Died 10 days after delivery—abscess of lung	1
Total	9
Total fœtal mortality in 200 operations including those babies dying before leaving the hospital	11 or 5.5 per cent.

fœtus in elderly primiparæ; prolapsed cord with ruptured membranes, large child, and unprepared soft parts, to the delivery of the physically unfit, and in cardiacs to lessen the strain of labor, also to women in labor after previous cæsarean sections because of the danger of rupture of the hysterotomy scar, for delivery in the presence of obstructive pelvic tumors or dystocias resulting from previous suspension operations which have become uterine fixations, and in deliveries after the cervix has been amputated and the pelvic structures repaired by extensive plastic operation.

In order to demonstrate that there is actually a greater morbidity and mortality in cæsarean than attends ordinary abdominal sections, and that therefore the indication should be definite and the operative conditions favorable, we have undertaken an analysis of twenty-two hundred cases. Two thousand of this number represent the abdominal

CÆSAREAN SECTIONS

Incidence of Section in Long Island College Hospital Series
8 in 1000 or 1 to 125

Incidence of Section in Johns Hopkins Hospital Series
9+ in 1000 or 1 to 110

Incidence of Section in Potter's Series
71+ in 1000 or 1 to 14

INFANT DEATHS

Long Island College Hospital Series
25 in 1000 or 1 to 40

Potter's Series
67.3 in 1000 or 1 to 14.8

deliveries in some of the leading obstetric clinics in America; and two hundred are taken from the case records of the maternity service of the Long Island College Hospital, from September 1, 1912, to September 1, 1921.

In the first group, owing to the incompleteness of the data supplied, we have been unable to do more than compute the mortality rates.

In the series taken from the records of our own service, we have been able to make a more careful analysis, and make a study not only of the mortality but of the morbidity incident to section.

In the first group of 2,000 sections collected from other clinics (Table I), we have divided the cases into the following classes:

1. The clean case—under this head we have included all of those elective cæsareans, where the operation was done before labor, or soon after labor had begun, and in which no vaginal examinations had been made.

2. The case potentially infected—in this class will fall those patients who have had a test of labor, with ruptured membranes, and those who have been subjected to repeated vaginal examinations by physician or midwife, prior to entering the hospital.

3. The frankly infected cases, or those which have been long in labor, with ruptured membranes, careless and repeated vaginal invasions, having had futile attempts at delivery before admission to the clinic.

The 200 cases of cæsarean occurring in the maternity service of the Long Island College

Hospital, were carefully reviewed, and the foregoing tables are based on the results of this study (Tables II to VIII).

Though it may be said that our series is too small from which to draw conclusions, we feel sure that the morbidity in cæsarean is vastly greater than is found in the ordinary clean abdominal sections.

If one thinks for but a moment that the uterine wound leads directly to an infected field, it is surprising that more lives are not lost.

Our bacteriological studies of the flora of the postpartum uterus, which have lately been confirmed by Loeser, show that on the fifth and sixth day, the majority of puerperal uteri contain pathogenic organisms, which have migrated into the uterus through the open cervix from the vagina. These, therefore, are brought in direct contact with the suture line, just at the time when if there has been any defect in technique, such a faulty hæmostasis, sutures tied too tightly or carelessly placed, the wound may become inoculated, and the infection spread along the suture line. This, and the admirable culture ground offered by the placental site, are, to our mind, the reasons for the high morbidity even in clean cases.

SUMMARY

A careful perusal of the foregoing statements and of the appended tables must leave the impression in the mind of the reader—

That surgical intervention is being too freely employed to terminate labor, and furthermore that the results for mother and child from such interference (oftentimes unindicated) with the physiological processes of labor do not justify their employment.

That the adoption of the principle and practice of *aseptic intelligent expectancy* in labor, when the factors of labor are known to be normal or approximate the normal, is still the safest method of delivery not only for the mother but for the fœtus.

That there is a high morbidity even in the *clean* cæsarean section, very much higher in fact than is common in operations for pelvic tumors, such as fibromyomata and ovarian cysts. This is due to the presence of infective bacteria in the cavity of the puerperal uterus, which migrate from the vagina to the interior of the uterus, through the open cervix.

That even in expert hands there is a definite maternal risk from cæsarean section, greater than is generally known. Our mortality studies show that this ranges from 2.9 per cent to 14 per cent, depending on the time in labor at which operation is done, after rupture of the membranes and on the amount of vaginal invasion present.

And finally, in view of these facts, we feel that every pregnant woman should have greater prenatal study and care than is commonly given her, so that complicating conditions may be recognized, prevented, or corrected before labor, and where this is not possible, the knowledge gained from this study will permit the obstetrician to conduct the labor in such an intelligent and aseptic manner, as to minimize the dangers from abdominal delivery.

TRAUMATOLOGY OF THE CARPUS

By A. H. BIZARRO, M.D., F.R.C.S.(Eng.), London
Late Orthopedic Surgeon, Royal Herbert Hospital, Woolwich

THE surgical importance of a well-defined knowledge concerning the traumatic conditions of the wrist is obvious. An early diagnosis of conditions leads to an early appropriate treatment on which the cure so much depends. Very often the so-called "sprains," synovitis, arthritis of several kinds, rheumatism . . . of the wrist are diagnosed a long time after a possible and almost forgotten trauma such as some of the several conditions that I am bringing forward in this article. There are 123 cases of carpal injuries in this series which have been collected from cases of my own and of the Royal Herbert Hospital. These cases are much more common in practice than our traditional knowledge leads one to think. The injuries have been grouped into (a) fractures of a single carpal bone, and (b) associated carpal lesions.

FRACTURE OF THE SCAPHOID

There were 68 cases of fracture of the scaphoid, or 55 per cent of the total number of carpal injuries. These have been divided into fractures with and without extrinsic synostosis.

Scaphoid fractures without extrinsic synostosis (Diagrams I and II, *1 to 55*).

MECHANISM OF FRACTURE

	Cases	Number of figure Diagrams I and II
Fall on the hand	41	
Fall on the thumb	1	*35*
Sprain	4	*3, 38, 44, 49*
Back-fire of motors	3	*8, 21, 41*
Crushed wrist	2	*7, 32*
Fall of weight on the wrist	2	*19, 28*
Boxing punch on the wrist	2	*2, 42*
	55	

The ages of these individuals were distributed as follows:

	Cases
Between 10 and 20	9
Between 21 and 30	22
Between 31 and 40	19
Between 41 and 50	5

These cases were seen as follows:

	Cases
Within 7 days after the accident	27
Within 30 days after the accident	8
Within 6 months after the accident	13
Within 1 year after the accident	4
Within 2 years after the accident	2
Within 3 years after the accident	1
	55

Thirty-eight cases were of the right and 17 of the left hand. Three were in females and 52 in males. In one case of fracture of the right scaphoid the left os magnum was equally damaged.

Scaphoid fractures with extrinsic synostosis. There were 13 cases, as represented in Diagram III and Figure 1, which shows the ages and dates when these cases were seen. In 12 cases the fracture was due to fall on the hand and in one, Diagram III, *5*, to the back-fire of a motor.

An analysis of these 68 scaphoid fractures reveals a great variety of types of injury which can be grouped into *incomplete* and *complete fractures*. The first are usually seen at the upper border of the scaphoid and seldom at its concavity—(Diagram I, *1* to *12*). The complete fractures may be seen with or without separation of the fragments, and the absence of the synostosis of the intrinsic type is the rule among these cases even if they are seen months or years after the injury. The direction of the crack or diastasis is to be seen at the head, waist, or neck, and very seldom at the tuberosity of the bone (Diagrams I and II, *13* to *55*). In some cases there is marked comminution of the fragments (Diagram II, *26*), which is even better seen in the lateral roentgenogram of the carpus, and usually is to be noticed at the back of the wrist as a dust of bone.

The *luxation* of the fragments usually affects the upper portion which appears displaced backward or more rarely forward. The displacement is to be seen in some cases in the anteroposterior roentgenogram (Diagram I and II, *13, 14, 30*). In some rarer cases

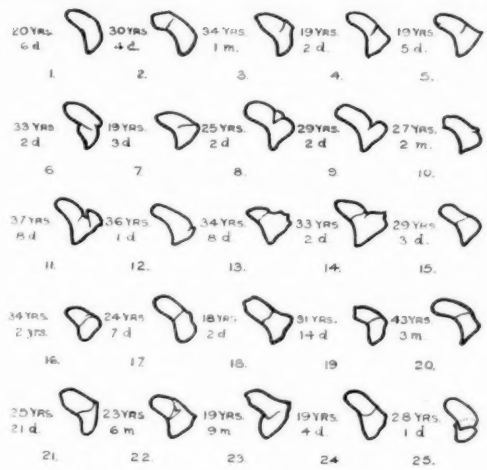


Diagram I. Twelve incomplete, *1* to *12*, and 13 complete scaphoid fractures, *13* to *25*. Notice in this and in the following diagrams the ages of the patients (upper figures), and the time elapsed after the accident (lower figures) are given at the left hand side of the drawings.

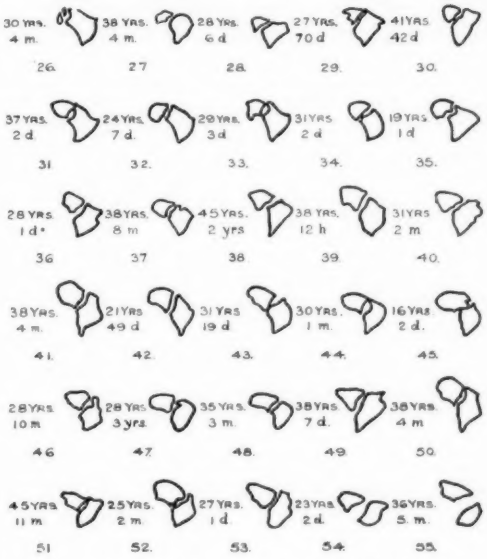


Diagram II. Thirty complete scaphoid fractures.

there is a compression of the fragments, besides the split in the bone (Diagram I, *16*, *25*). In Diagram I, *16*, the compression is not accompanied by luxation as in *25* where the lower fragment is crushed behind the upper. The more marked navicular luxations are to be seen when there is an associated carpal lesion, such as in case of retrolunar luxation of the os magnum, etc.

I have divided the synostosis into *intrinsic* and *extrinsic*. The first variety is seldom seen and corresponds usually to a prolonged period of immobilization of the wrist after the trauma (Diagram I, *22*). The average cases, however, are as shown (Diagram II, *38*, *42*, *46*, *47*, etc.) where several months and years have elapsed after the accident and yet the fragments remain completely "pseudarthrosed." Occasionally there is an attempt to union in one or more points of the line of fracture (Diagram II, *43*, *51*) which can be called incomplete union. Usually a mass of granulation tissue forms between the fragments which is shown by the cases operated upon.

The *extrinsic variety of synostosis* is commonly met with and does not necessarily mean either too long a period of time elapsed after the accident (Diagram III, *2*, *10*, and *12*), or too long a period of wrist immobilization as a means of treatment. The commonest type is the union between the distal navicular fragment and the radius. This occurred in 70 per cent of the cases (Diagram III, *5* to *13*). The next common type is where the distal navicular portion synostoses with the os magnum (Diagram III, *2*, *3*, *10*, *12*, and *13*). The proximal scaphoid fragment occasionally is synostosed with the radius or semilunar (Diagram III, *1*, *4*, *12*, and *13*), and the distal fragment more rarely still may unite with the trapezium or the trapezoid (Diagram III, *11* and *12*). The degree of functional disability is usually proportional to the extent of the synostosed areas, of which (Diagram III, *13*) is a good example, showing a severe degree of fusion accompanied by marked local swelling, pain, and limitation of movement. It is remarkable, however, that some cases display a great impairment of function notwithstanding an apparently slight lesion as was the case in Diagram II, *38*, in which there was no synostosis of any kind. The age, general condition, rheumatoid diathesis, neurasthenia, eagerness in claiming compensation, are all factors of great importance. It will be noticed that there was not among

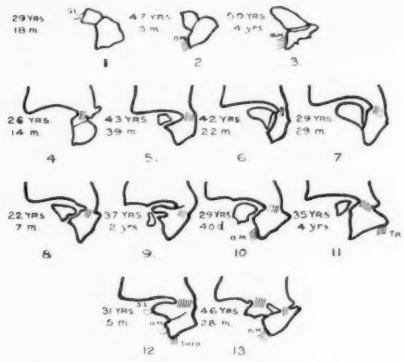


Diagram III. Thirteen complete scaphoid fractures and the varieties of "extrinsic" synostosis.

these patients a good example of cuneiform fracture of the navicular tuberosity, as in one of Blau's and Eisendrath's cases, nor any longitudinal type of crack along the bone as described by Guibout.

2, a. Fractures of the semilunar. There were two cases only—1.5 per cent of the carpal lesions. One showed a vertical, incomplete crack at the upper border of the bone, and the other was a case of compression fracture with cuneiform synostosis. The former was due to a fall on the palm and the latter to a kick from a horse.

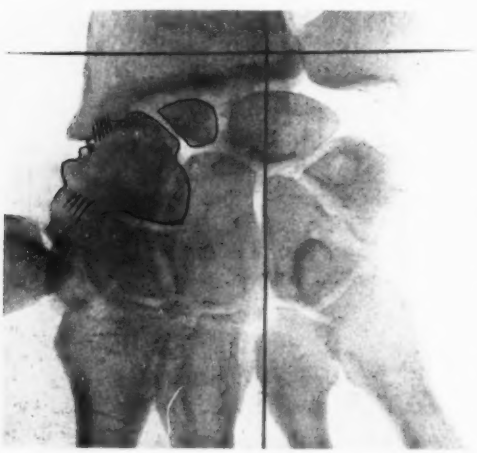


Fig. 1. This is the same case as represented in Diagram III, *11*. It is given here to make clear Diagram III.

3, a. Fracture of the os magnum. There were 6 cases, 4.9 per cent, Diagram IV. These fractures were due to falls on the palm of the hand, were all incomplete, and in 50 per cent of the cases were seen at the inner border of the neck of the bone (Diagram IV, *1* to *3*), in two cases the split occurred at the outer border and corresponding to the point of articulation with the scaphoid tuberosity, just above the capitotrapezoid ligament (Diagram IV, *4* and *5*); and, in one case it was a simple crack at the postero-inferior angle of the os magnum (Diagram IV, *6*). These cases were seen stereoscopically and this was confirmed by the lateral roentgenogram, and in some cases the opposite wrist was X-rayed as as well. The last case above mentioned was not an "os magnum secundum" but a real crack. In one case of left os magnum fracture, the right scaphoid was fractured as well (Diagram I, *13*, and Diagram V, *3*.)

4, a. Fracture of the unciform. There were four cases, 3.2 per cent, as in Diagram V. In three cases (Diagram V, *1* to *3*) the crack occurred at the outer border and inferior angle of the bone corresponding to the surface where the strong capito-unciform ligament is inserted. In one case (Diagram V, *4*), the uncus was fractured at its base, and the roentgenographic appearance was peculiar, showing a marked downward digression of the shadow of the uncus in the palmar view. They were all cases of fall on the palm.

ASSOCIATED CARPAL LESIONS

1, b. Scaphoid and radius. There were seven cases, 5.7 per cent as shown in Diagram VI. They were all due to falls on the hand, excepting Diagram VI, *6*, which was due to a back-fire. These cases produce very distressing symptoms. The radius in two cases (*4* and *5*, Diagram VI) was broken as in Vialle's fracture. In two other cases the crack (*1* and *2*, Diagram VI) occurred at the articular radial end only. In one case only the radial split corresponded to the navicular diastasis (Diagram VI, *1*, and Fig. *2*), but in two the radial crack was at the ulnar side of the center of the articular line. In one case (*3*, Diagram VI) the radial crack was seen at the outer border of the styloid only, of which *5*, Diagram

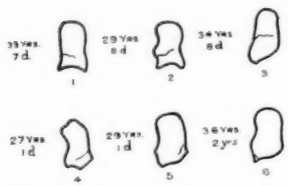


Diagram IV. Six incomplete fractures of the os magnum.

Diagram V. Four fractures of the unciform; *4* represents a fracture of the unciform process.

VI, is a more advanced condition. The case represented by *4*, Diagram VI, is, as it were, the continuation of what happened in cases represented by *1* and *2*. In *7* is shown a case of epiphyseal separation with backward luxation of the distal fragment and some navicular comminution. In none of these patients was there a fracture of the radial diaphysis as in Beck's case.

2, b. Scaphoid and ulna. There were three cases of real ulnar fracture (Diagram VII, *2*, *4*, and *5*), and two cases of ulnar styloid division. This division is in the case represented by *1* in Diagram VII, a typical "ulnare antebrachii," and in *3*, one rare example of congenital non-fusion of the styloid, os triquetrum secundum. In *2*, is shown a fracture of the styloid tip, and in this case the bony fusion is well marked in contradistinction with the congenital cases where there was a well-defined and straight gap. In cases shown by *4* and *5* in Diagram VII, there was a fracture of the lower ulnar end. In the last case the ulna was luxated backward as well, and the fall was due to a motor bicycle collision. In one case not represented in this series there was an associated fracture of both radius, ulna, and the scaphoid resembling Rutherford's case. There was not any fracture in this group resembling Potherat's.

3, b. Scaphoid and semilunar (fracture and dislocation). There were eleven cases of combined lesions. In 4 cases the naviculolunar contact was the seat of a crush which involved and compressed the contiguous portions of the two bones. In two of the above-named

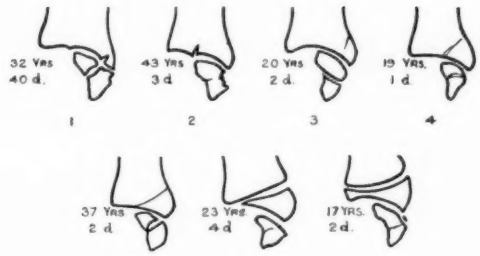


Diagram VI. Seven combined naviculoradial fractures.

cases there had been a back-fire, and in the two remaining, one fell on the palm of the hand and the last sustained the fall of a heavy object on the wrist. In 3 cases there was a fracture of the navicular head or body and crushing of the semilunar at the points of contact with the scaphoid and radius. Two of these cases were due to crushing of the wrist by heavy objects and in the third the lesions were due to a severe sprain. In one case there was radiolunar synostosis.

In another case due to a fall on the palm of the hand there was a total compression injury

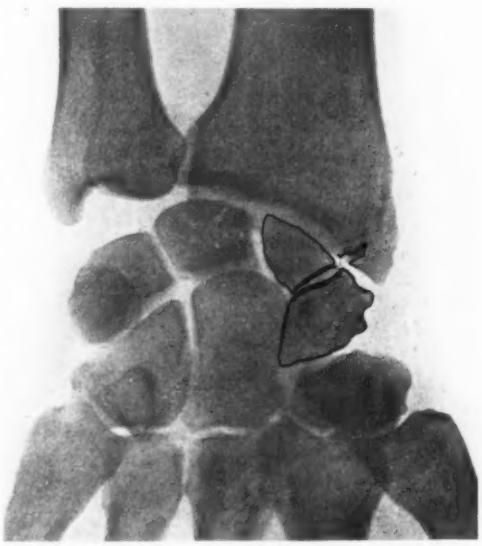


Fig. 2. This is the same case as represented in Diagram VI, *1*.

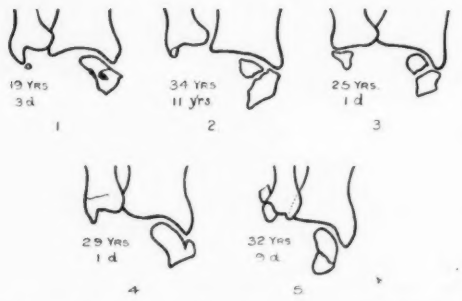


Diagram VII. Three combined naviculo-ulnar fractures (*2*, *3* and *5*) associated navicular fracture and "ulnare antebrachii" (*1*) and associated navicular fracture and (?) "triquetrum secundum" (*3*).

of the semilunar which was perpendicularly luxated forward, and the fracture of the scaphoid waist was accompanied by intrinsic and extrinsic synostosis.

In the last three cases (Diagram VIII, *1*, and Figs. *3*, 4, and 5), the lesions are even more complex. The first case shows a dislocation forward of both scaphoid and semilunar. The scaphoid was the seat of a crack slightly above the waist which was confirmed at the operation. In Figure 4, is represented a case seen *33* months after resection of the semilunar and proximal scaphoid fragment which had been performed 3 months after a backfire. This roentgenogram shows a marked alteration in the carpus, but the range of movement was fair. In Figure 5, is shown the last case of this group. These lesions were due to a fall on the hand in extension. The semilunar is luxated forward and is the seat of marked calcareous atrophy. The ink lines shown in the roentgenograms were drawn after a careful stereoscopic search. The proximal scaphoid fragment is luxated backward. This was a case of divergent naviculolunar luxation. The ages of these individuals were between *23* and *43* years. Eight cases were of the right and *3* of the left hand.

4, b. Scaphoid and cuneiform. There were two cases as shown in Diagram IX. Both resulted from falls on the hand, and the lines of the cuneiform fracture are in one case, *1*, Diagram IX, an incomplete vertical crack and in the second, *2*, Diagram IX, a transverse complete fracture. In this case the distal navicular fragment was synostosed with the radius.

5, b. Scaphoid and trapezium. There was one single case of fracture of the navicular waist and compression fracture of the navicular tuberosity and trapezium. This was due to a fall on the palm of the hand in a girl aged 19 years.

6, b. Scaphoid and os magnum. There were four cases shown in Diagram X, *1* to *3*, and the last not included there, being like *3* as far as the os magnum is concerned, but slightly higher than the level of the navicular crack. The fracture represented in *1* was due to the passing of the wheel of a car over the wrist, and in that represented by *2* to a back-fire which produced a complete transverse crack of the os magnum neck. The other two were due to falls on the palm of the hand. This type of os magnum fracture and those described above (Diagram IV) are by far the commonest—Guermonprez, Moty, Robert. The vertical split appears to be of great rarity.

7, b. Scaphoid and unciform. There was one case due to a fall on the palm of the hand. The scaphoid fracture was comminuted at the waist and the unciform was cracked as in Diagram V, *1*.

8, b. Scaphoid, semilunar, and radius. There was one case due to a fall on the hand. The radial fracture resembled that seen in Diagram VI and the naviculolunar lesion was one of compression and comminution at the zones of contact between the bones.

9, b. Scaphoid, semilunar, and ulna. There were two cases (Diagram VIII, *2*, and Fig. 6, *16*). Both were due to falls on the palm. The former displays a divergent fracture-luxation of the semilunar and proximal scaphoid segment, and os magnum-unciform fusion. The latter is a case in which both the semilunar and the proximal navicular portion are reluxated forward. In both cases the ulna fracture is located at the styloid process.

10, b. Scaphoid, semilunar, and os magnum. There were two cases due to falls on the palm. In Diagram X, *5* is represented a fracture-compression at the scapholunar junction, a vertical crack on the radial surface of the

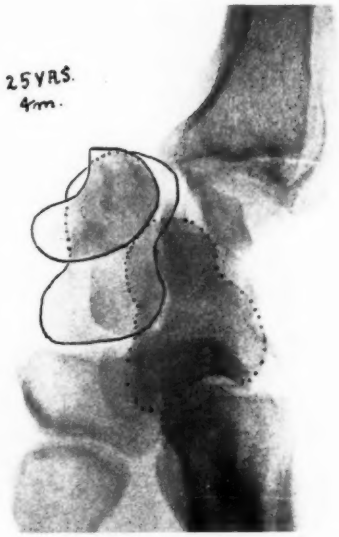


Fig. 3. Lateral view of same case represented in Diagram VIII, *1*.

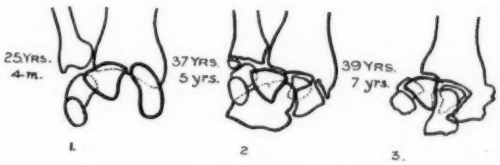


Diagram VIII. Three cases of semilunar displacement or backward dislocation of the os magnum. *1* represents an associated luxation forward of the scaphoid; *2*, an associated dislocation backward of the proximal scaphoid fragment, fracture of the ulnar styloid, and os magnum unciform fusion; and, *3*, an associated backward luxation of the proximal scaphoid portion, cuneiform fracture-indentation of the os magnum. In these last two cases there is extrinsic radial synostosis of the proximal navicular fragment. Note the triangular outline of the semilunar and the extent of its cuneiform superimposition.

semilunar and the os magnum showed a small oblique crack in its lower border. The second case is represented in Diagram VIII, *3*, and it shows a luxation forward of the semilunar, backward dislocation of the navicular proximal fragment, an os magnum crush at the point of contact with the navicular tuberosity, and a very marked scaphoradial synostosis of the distal segment. The semilunar was not in any of the cases of this series fractured in several places (Peste), or fractured transversely as in Hunt's case.

11, b. Scaphoid, semilunar, os magnum, and unciform. There was one case due to a fall on the palm, and seen 18 years after the accident (Fig. 7). There are very marked secondary changes in the radius, a luxation forward of the semilunar, a fracture and extrinsic radionavicular synostosis, and a crack through the unciform and os magnum where motion apparently took place.

12, b. Scaphoid, trapezoid, and os magnum. There was a case as shown in Diagram X, *4* and due to a fall.

13, b. Os magnum and trapezoid. There was one case, Diagram XI, and due to a fall on the palm of the hand.

14, b. Os magnum and unciform. There was one case seen 3 months after a fall on the palm of the right hand which showed impaction between the articular surfaces of both bones.

15, b. Os magnum and metacarpals. This was the case of a woman 28 years of age, who fell on the dorsum of the hand. It proved to be an incomplete crack of the os magnum as in Diagram IV, *1*, and an oblique fracture of the bases of the third and fourth metacarpals which ran downward and inward.

16, b. Trapezium and metacarpal. This was a fracture of the internal and inferior angle of the trapezium and a small crack at the outer border of the base of the first metacarpal. The fall took place on the thumb flexed on the palm of the hand.

17, b. Cuneiform, pisiform, unciform, and metacarpal. This was the case of a fall on the ulnar border of the wrist. There was a fracture of the cuneiform similar to that shown in Diagram IX, *1*, an oblique crack of the pisiform, a fracture of the ulnar border of the unciform running upward and outward and an oblique crack at the inner border of the base of the fifth metacarpal. The lateral roentgenogram revealed numerous fragments of bone at the level of the carpal damage.

18, b. Carpal fusion. This was the case of a very severe crushing injury penetrating to the carpus (Fig. 8). The wrist was ankylosed in a position of 15 degrees of palmar flexion. There was very marked metacarpophalangeal rigidity. Figure 9 is a roentgenogram of the

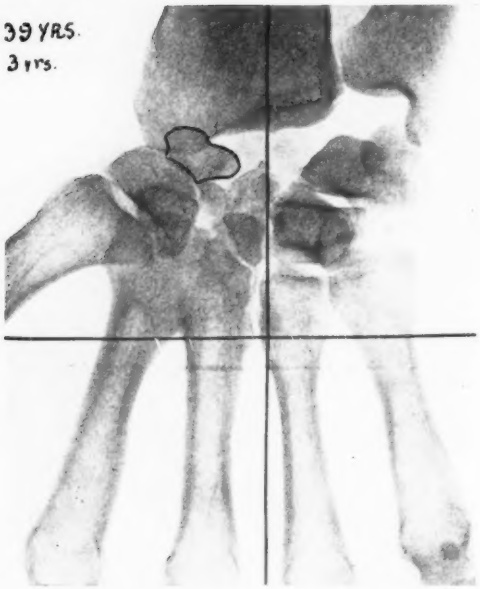


Fig. 4. Result of the resection of the semilunar and proximal navicular fragment 33 months previously. Note secondary changes in os magnum and radius.

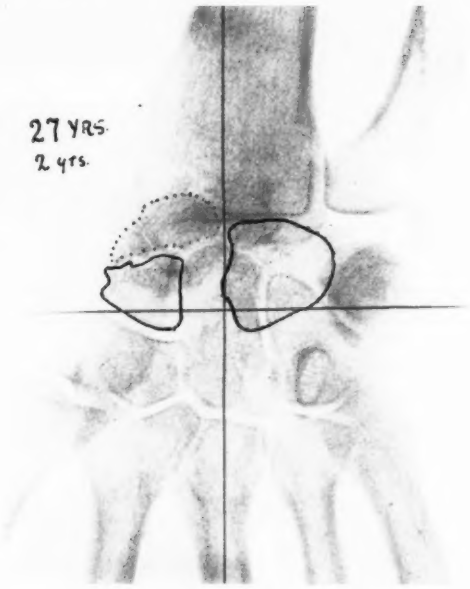


Fig. 5. Shows the after-result of combined semilunar os magnum luxation and posterior displacement of the proximal scaphoid segment, seen 2 years after the accident. The displaced semilunar is the seat of very marked calcareous atrophy. Note the extent of its radial-cuneiform-os magnum and unciform superimposition.

same wrist taken 30 days after the operation for "mobilization" and with the hand kept in extension to the end of a Thomas' arm splint. Figures 10 and 11 show the degree of motion obtained 3 months after operation.

An analysis of the *histories* given by the cases above referred to, shows that a fall on the hand is by far the commonest mechanism of fracture. The fall usually takes place as described by one of the cases (Diagram II, *39*) a doctor, as follows: "I was thrown from my motorcycle and landed on my hands, striking the kerb with the palmar aspect just below the wrist." I have examined the new pair of gloves he was wearing at the time, and by the erosion in the leather it can be said that the fall was on the hypothenar eminences with the hands adducted. In some cases it is the thenar eminence that strikes the ground. The fall on the dorsum of the hand occurs in a few cases, and in a fewer number still on the metacarpal heads with flexed thumb or fingers. The direct type of injury—fall of weights on the wrist, crushing injuries, kicks, and direct back-fires—are rarer. The indirect type of back-fire in abduction occurs more commonly than the direct. The *mechanisms of the injury* were distributed as follows:

	Cases
Fall on the hand	100
Fall of weight	14
Back-fires (indirect)	9
Total	123

After the accident has happened the patients usually notice in the case of *navicular injury or upper carpal syndrome* that "it is too painful to bring the thumb into action in any way." And a little time after that "the pain is severe, of a dull aching character, which makes one feel somewhat sick." The pain is to be felt "all round the wrist, and it appears to be impossible to find any position to lessen it. Sometimes such a position appears to be found, but it becomes intolerable after a while." The movements of

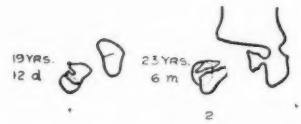


Diagram IX. Two associated naviculo-cuneiform fractures.

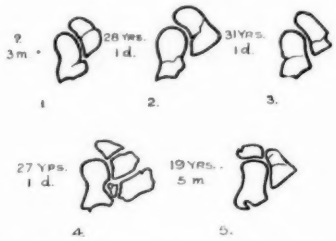


Diagram X. Three naviculo-os magnum associated fractures (*1* to *3*); a combined naviculo-trapezoid-os magnum fracture (*4*); and, a combined naviculo-lunar fracture-compression, and lunar and os magnum fracture (*5*). *2* demonstrates a complete fracture of the os magnum neck as well.

the pollex and the extension of the wrist are the most painful.

In the case of the *os magnum retrolunar luxation* or what might be called the *lower carpal syndrome* the main feature of the history is the rigidity and stiffness noted *ab initio* by the patients. The pain may be even more severe than in the case of the upper carpal syndrome, and that invariably means involvement—stretching or even rupture—of the median and more rarely the ulnar nerves.

In the *late cases*, those seen sometime after the injury, the histories vary somewhat (Marshall). A rather common feature of some of these cases is the complete oblivion of the trauma. And then they come up complaining of several degrees of disability: painful extension or flexion of the wrist after a certain point; the need of having "to let go" in some attitude of the hand performed hurriedly, which in some cases can be avoided whenever the patient's attention is concentrated on the movement; difficulty or inability in grasping objects, tools, sporting clubs, owing to pain, muscular weakness . . . ; some more or less marked degree of swelling, accompanied or not by pain; more or less marked degree of articular stiffness; nervous dystrophies of the

Diagram XI. A transverse associated fracture of the os magnum and trapezoid.

hand, etc. In some cases the history is definitely allied to the trauma that produced it.

It will be noticed after reviewing the above cases that the bones entering into the formation of the wrist were involved, as shown in table.

	Cases	Single Lesion Cases	Associated Lesions Cases
Radius	8	0	8
Ulna	7	0	7
Scaphoid	106	68	38
Semilunar	20	2	18
Cuneiform	3	0	3
Pisiform	1	0	1
Trapezium	2	0	2
Trapezoid	2	0	2
Os magnum	15	6	9
Unciform	8	4	4
Metacarpals	3	0	3

This shows the scaphoid to be the bone most commonly involved and the pisiform the rarest. The semilunar and os magnum are next in importance after the scaphoid. They are both intimately in correlation as will be shown later. The proximal scaphoid fragment was very markedly luxated forward in 4 cases, and backward in 3 cases. There were 8 cases of combined semilunar-os magnum luxation, and two of these cases showed a divergent type of naviculolunar displacement. The cases of rotation of the fragments *in situ* are not included among the above-named. The ulna was luxated backward in one case. It is worth mentioning that the dislocations met with in this series never attained the degree described by Couteaud, Nicotra, etc. It will be noticed that 35 per cent of the navicular and 90 per cent of the semilunar lesions were of the associated type. Fifty per cent of the semilunar lesions were due to the luxation backward of the os magnum.

DIAGNOSIS

The upper carpal syndrome corresponding to the navicular fractures and associated lesions gives rise to a swelling over the scaphoid area; lower radial or wristlet-like pain on attempting to move the pollex or abducting

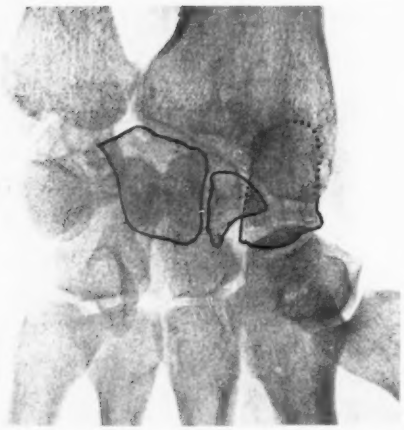


Fig. 6. An old associated naviculolunar displacement forward, and ulnar styloid fracture. Note the marked secondary carpal changes and the calcareous atrophy of the luxated bones. This is a case of 6 years' duration.

the wrist; fork-like deformity of the wrist if there is a radial lesion with displacement and, alteration in the alignment of the styloid line should the radius, ulna, or both be involved. Ecchymosis is rare in the single scaphoid injury and usually suggests an associated lesion.

The lower carpal syndrome, corresponding to the os magnum-semilunar associated displacement, is characterized by an increase in the anteroposterior diameter of the wrist; palmar swelling below the center of the styloid line; depression at the knuckle line of the head of the third metacarpal; low type of fork-like deformity of the wrist; and, stiffness of the fingers which are usually held in slight extension.

The Vaughan percussion test described by Murphy shows, in the early stages of these conditions, the maximum of tenderness to be at the third metacarpal head in the lower carpal, and at the second metacarpal head in the upper carpal syndrome.

Crepitation is very seldom felt in the single injuries, and its presence in my experience represents an associated lesion of the wrist.

I shall refer very briefly to some points on the morphology, physiopathology and radiology of the carpus as the best means of understanding the facts given above and their clinical interpretation.

MORPHOLOGY

An examination of the skeletons of certain vertebrata of aquatic habits — crocodiles, phoca, whales — reveals the ulna to have marked carpal connections, and the two carpal ranges to be formed by arthrodia of uneven surface which come, in the boundary zone between the proximal and distal carpal series, to a straight line.

In the heavy mammals—rhinoceros, elephant—the ulnar contact with the carpus is very marked; the ulna appears to be the dominating forearm bone, the radius twists in front of it, the deambulation is in pronation; and again the carpal bones are regular and evenly distributed. The pisiform is in these animals a well formed bone.

In the bovidæ and equidæ the ulnar carpal connection is rudimentary, the ulna is an elbow structure; the carpal anatomy is simple; the articulations are of the arthrodial type, and the line between the proximal and distal carpal ranges is linear; and the pisiform is a well-formed structure.

If the smaller monkeys—semnopithecus entellus—are analyzed it will be seen that the pisiform appears like the posterior tuberosity of the os calcis in the foot. At first sight the hand looks like a foot. In the tiger, hyena, bear, dog, the pisiform assumes a position and importance as shown in the monkey entellus, for instance.

The examination of a higher monkey skeleton, troglodytes gorilla, demonstrates the ulnar carpal connections to be very faint, a marked mesial forearm twist, the great size of the scaphoid tuberosity and pisiform ridges of the trapezium and uncus of the unciform, and an already well-established connection between the os magnum head and the proximal carpal range. Condylarthrosis appears to be the type of articulation between some of the carpal bones. The hand is an organ of progression as well as of prehension. The ligaments of these articulations resemble very closely the human.

In some of these animals, sea-lion, tiger, cat, dog, etc., the scaphoid is fused with the

semilunar, and in some cases other intercarpal fusions or duplications are to be noticed.

In man the hand is no longer an organ of locomotion being only a prehensile instrument that is anatomically represented in the carpus by the following features. The os magnum head forms a center of marvelous anatomical contact; it is the pivot of the system. There is a reciprocal fitting in of the os magnum head into the proximal, and of the scaphoid foot with the distal carpal range. The anatomical fusions are rare, i.e., the scaphoid-centrale. The pisiform almost disappears since it is the representative in the carpus of manual deambulation, it is the heel of the hand of non-aquatic vertebrata and a regressive structure in man. All the ridges and tuberosities, so well marked in the troglodytes, are ill developed because man has no longer to climb trees for his existence. The ulna-cuneiform contact is very faint and through the triangular ligament which is well developed in monkeys. In fact the ulna is an elbow structure. The intercarpal articulations attain the highest degree of mechanical differentiation: condylarthrosis, an idea of slight enarthrosis, and a very marked inter relation between the proximal and distal carpal ranges, leading to delicacy and firmness of motion, is to be seen in the arthrology of the human carpus. These plastic facts are in accordance with the high functional value of the hand of man and with the difficulty in explaining the physiopathology of the wrist, and the synergy of the movements performed at the same time by the several anatomical elements of the carpus.

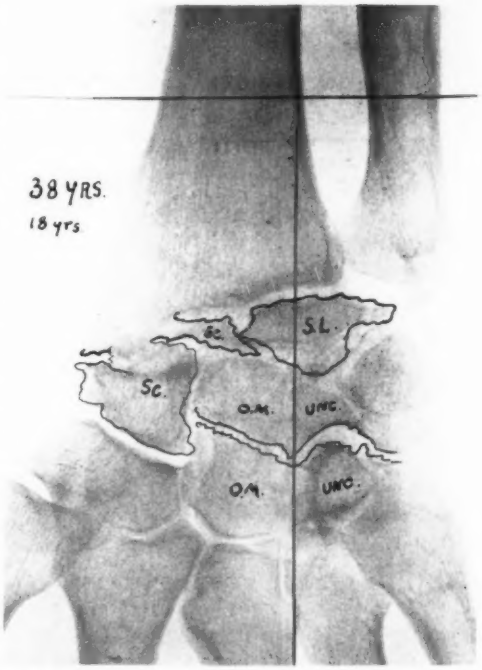


Fig. 7. Shows an old (18 years) associated naviculo-lunar displacement forward, and os magnum unciform transversal crack. Note the double scaphoid radial synostosis and degree of inflammatory fusion of the upper carpal range.

PHYSIOPATHOLOGY

The movements of the carpal bones can be followed by reading Diagram XII, which represents 3 lateral roentgenograms of the wrist taken in *full extension* (*1*), *extension* (*2*), and *full flexion* (*3*).

In hyperextension, *1*, the scaphoid is slightly inclined backward and upward, the semilunar articulates with the center of the radial articular surface by its postero-superior surface, the os magnum is inclined upward and its head articulates with the antero-inferior part of the semilunar.

In extension, *2*, the scaphoid assumes a more inclined position backward and upward, the semilunar is horizontally placed, and the os magnum body has advanced forward.

In hyperflexion, *3*, the scaphoid head is looking backward, its foot is almost touching the radial brim; the semilunar follows the scaphoid head and by the middle of its upper surface articulates with the posterior part of the radial surface; the os magnum head now articulates more fully with the semilunar, and its body has advanced forward. The trapezium and trapezoid follow the navicular foot, the unciform the os magnum base, and the cuneiform the semilunar. In fact, Destot stated that the semilunar and cuneiform act as a meniscus to the radius and distal carpal range.

If pressure is now exerted in the palm of the hand, thenar, or hypothenar eminences,

Fig. 8. A case of carpal traumatic fusion.

Fig. 9. Same as represented in Figure 8 one month after the operation of "mobilization." The hand is in an extension splint.

and heads of the metacarpals and back of the hand in the three positions chosen and roentgenographs are taken as before, it will be seen that the scaphoid is the bone which will behave differently. In fact, in position of hyperextension, *1*, if the thenar eminence is forcibly pressed on and consequently the navicular tuberosity, the pressure transmitted along the body of the bone will force the scaphoid head backward which will assume a position like that seen in Diagram XII, *2*. This is, as it were, an anticipation of the attitude of the bone. The other bones will only show a more accentuated attitude, they all become more clearly horizontal, vertical, etc. In position of hyperflexion, *3*, it will be seen, however, that the os magnum head articulates with the anterior horn of the semilunar and becomes even obliquely placed backward. A marked contraction of the flexor muscles of the wrist will bring the pisiform well away from the cuneiform. This shows how the pisiform is emancipated from the human carpus in so far as the refined movements are concerned.

The physiology of the movements of abduction and adduction of the wrist is too well known to need repetition (Bryce, Destot, Lesshaft). Again the navicular and the semilunar are the bones that show a greater degree of excursion on the radius.

The dissection of the carpus will explain the facility of movement that some of these bones have exhibited in the directions above referred to. It will be seen that there is a fascial layer all round the wrist which hides the capsules of the joints beneath. The removal of these capsules shows the os magnum head to be the point that displays the greater freedom of ligaments. The os magnum base is, by means of bands filling in the interosseous intervals, well attached to the bones surrounding it. From the anterior horn of the semilunar radiates upward and outward a triangular band attached to the outer third of the radial brim. If the wrist is then flexed there will be seen at the inner end of the radial articular edge an identical type of band radiating toward the naviculolunar junction, and if flexion is forced further the upper pole of the semilunar is found bound up to a fascial band which attaches it to the cuneiform and triangular ligament. The examination of

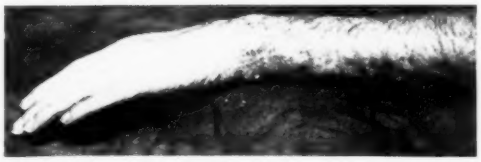


Fig. 10. Same case as in Figures 8 and 9, 3 months after the operation.

Fig. 11. Same case as in the three preceding figures, 3 months after the operation, displaying the extent of motion obtained.

one's hand demonstrates the scaphoid under the radial styloid when the wrist is adducted, and the os magnum head can be seen and felt as a definite lump at the back of the hyperextended wrist. It can, therefore, be said that each carpal bone has a definite and independent function to perform throughout the various stages of movement of the wrist. Some of these anatomophysiological points have been brought forward in the well-known works of Destot and his school, Delbet, Jeanne and Mouchet, Tanton, etc.

The scaphoid fracture occurs in the case of hyperextended wrist if the hand is abducted (Destot, Codman and Chase, Gabaglio, McCarty, Pilcher, Schulz, Skillern and Speese); and if the hand is adducted, as Destot claims, the scaphoid, the radial styloid or a posterior marginal fracture (Letenneur) may be the consequence. An anterior marginal fracture (Barton), a fracture of the scaphoid or a fracture compression of the naviculolunar contact or of the semilunar itself associated or not with backward displacement of the os magnum may result from a fall on the palm of the hand. This has been proved by means of experimental work and by the evidence of clinical data. The marginal fractures are the rarest in our experience. The abduction compression fractures of the naviculoradial junction (Diagram VI, *4* and *5*) have been described by Vialle, Caccia, and Pilcher in great detail. These fractures are usually the result of an indirect back-fire. The ulna appears to be fractured when there is a marked abduction trauma which, by a mechanism identical with that producing a Pott's fracture, explains the scaphoid fracture and the ulnar styloid injury. If the force is great the triangular ligament can be ruptured and the ulnar end may be luxated backward or forward, if a movement of torsion is present in conjunction with the trauma (Diagram VII, *5*). The combined naviculolunar injuries may be explained by a similar conception. In some rarer abduction carpal fractures the foot of the navicular appears to press on the os magnum waist and produce either on its outer border, inner border, or by propagation through to the unciform some of the fractures described above (Diagram IV, V, and VIII). The anatomical distribution of the carpal interosseous ligaments appears to explain satisfactorily the distribution of these fractures. The displacement of the scaphoid fragments is understood by means of the movements it displays and by the distribution of its ligaments. For instance, a sudden force

Diagram XII. The relative positions of the scaphoid, semilunar, and os magnum assumed by these bones in the hyperextension (*1*), extension (*2*), and hyperflexion (*3*) of the wrist.

Fig. 12. Shows the plaster splint applied in a case of navicular fracture. Note the fixation of the thumb.

acting on the thenar eminence will, by pressing on the navicular foot, luxate its head backward and produce a fracture of the scaphoid (Auvray, Ely, Russ, Stimson). The navicular fractures due to direct injuries usually occur as the result of circumduction movement produced by the trauma. The fracture happens before the scaphoid assumes an anteroposterior direction which is seen at the last stage of wrist hyperflexion (Diagram XII, *3*). A sudden hyperextension of the wrist due to back-fire, fall on the palmar surface of the metacarpal heads originates some of these fractures which are better understood by the position of the navicular (Diagram XII, *1*) vertically placed against the radial surface. The types of combined naviculolunar displacement are explained by Diagram XII, *1* and *2*. The navicular head will be forced backward through pressure on the tuberosity, the head of the os magnum being displaced in the same direction. The semilunar then slips in an opposite direction forward and a divergent type of dislocation results.

The semilunar and os magnum (Diagram XII) are intimately associated (Blake, Codman and Chase, Groves, Hessert, Hildebrandt, Jeanne and Mouchet, Lesser, Lilienfeld, Murphy). Some of the debated points have been settled by Delbet "that the luxation backward of the os magnum brings back all the carpus with the exception of half of the scaphoid, and sometimes the cuneiform, after rotation of the semilunar by the os magnum." The trauma may occur with the wrist in any of the positions above named. The integrity of the radiolunar ligaments will prevent a more advanced degree of the lunar luxation, as the posterior fascial capsule will avoid a higher backward displacement of the head of the os magnum. The incomplete rupture of the anterior radiolunar ligament explains the anterior horn as the semilunar acts as the center of fixation for its dislocations. The os magnum head slips backward under the demilunar facet (Diagram XII, *3*), and actually presses on the posterior horn of the semilunar when returning to the former position. Hence the designation of the semilunar luxation as backward dislocation of the os magnum or retrolunar displacement. The extent of the lateral deviation of the wrist associated with a variable degree of flexion and extension renders the possibilities of the mechanism of these fractures and fracture-dislocations even more complex. A systematization of these injuries is described in the work of Jeanne and Mouchet. The varied degrees of semilunar displacement is well brought forward in Murphy's lecture. In none of the cases of the series was I able to find a case similar to Bolton's radiolunar lesion.

CARPAL RADIOLOGY

The way in which the carpus has been centered has a great bearing on the radiological findings. To this effect I have examined a series of plates of the extended wrist centered as follows (a) on the lower third of the forearm; (b) on the wrist itself; (c) on the metacarpal region.

In position *a* the radio-ulnar outline is linear; the scaphoid appears lengthened and its foot overlaps part of the three outer bones of the distal carpal range; the contiguous surfaces of the semilunar and cuneiform are superimposed; the carpometacarpal line appears as if fused; and there is distal digression of the pisiform and shadow of the uncus.

In position *b* the radio-ulnar outline is double; the scaphoid is shorter and less overlapped by the shadows of its neighbors; the luno-cuneiform junction is still indistinct; the separation between the proximal and distal carpal ranges is more distinct than the carpometacarpal line; and there is less downward digression of the pisiform and uncus.

In position *c* the radio-ulnar outline is linear; the scaphoid appears shortened and the outline of the tuberosity projected on the body may resemble a crack; the articular carpal separation is clear; the semilunar is slightly superimposed on the radius, and there is a clear view of its posterior horn; the carpo-metacarpal line may appear double in places through superimposition of images and give the appearance of fracture; and there is proximal digression of the pisiform and shadow of the uncus. It appears, therefore, that the upper metacarpal exposure brings into view the clearest detail and individualization of the proximal carpal range; and the

central or carpal exposure the best view of the distal carpal range. The pisiform and the shadow of the uncus are the best points of reference for establishing how the carpal views have been taken. These facts are even more clear in stereoscopic roentgenograms which should always be taken. It is hardly necessary to insist on the importance of the lateral roentgenogram, a careful reading of which gives the exact displacement and degree of comminution of the fragments, which appear in some cases as a bony dust.

The control view of the opposite carpus, taken in another plate, excludes some congenital conditions which can be unilateral as I have verified. Among the commonest are to be mentioned the "epilunatum," "pretrapezium," "ulnare antebrachii," "os triquetrum secundum" which appear in 1 per cent of cases. The navicular is the carpal bone more commonly congenitally divided in 2 pieces (1 per cent), 3 or 4 fragments, although Dwight's view that a fractured scaphoid is only a separation of the pieces of a "naviculare bi- or tripartitum," appears to be not the case. The degree of comminution, the variety and levels of the lines of fracture, the features of the edges, the gap between the fragments, and the appearance of the navicular surfaces as shown after removal (Todd) exclude that theory.

The anteroposterior image of a displaced semilunar is not only conical, as Murphy pointed out, but the degree of radial-cuneiform-os magnum-unciform superimposition is very marked (Diagram VIII, *1* to *3*, and Fig. 5) in any of the 3 above mentioned positions of exposure. The shapes of the scaphoid varying from a reniform appearance to a more or less cylindric figure (Gruber) impart to the radiological appearance of the bone some differences of outline.

TREATMENT

The upper carpal lesions usually require rest and the lower ones early movement. If the case is seen early any dislocation should be reduced preferably under a general anæsthetic. The wrist should be, in the case of scaphoid fracture, mantained for 4 weeks as in Figure 12. The plaster is changed twice because it gets loose and to allow for slightly altering the degree of wrist hyperextension. The pollex is included since it forms the continuation of the naviculo-trapezium pillar, whereby comfort is given to the patient who stops "feeling pain" and only "feeling the wrist." In old cases forcible wrenching, as advised by Sir Robert Jones, and in some patients where there is pain or radio-navicular synostosis, resection of the scaphoid sometimes relieves the pain and improves the degree of mobility of the wrist. The wrist is maintained, for sometime, in a well-fitting leather bracelet which appears to avoid the development or the aggravation of secondary tenosynovitis. The tenosynovitis when present is improved sometimes, by means of thermotherapy, heliotherapy, and electrotherapy. Early movements should be advised after the reduction of the os magnum retrolunar luxation.

If the fragments cannot be replaced they should be removed. A palmar incision is preferable for the semilunar and a lateral one for the scaphoid. Early movements should be advised. Figure 3 shows a case of semilunar and proximal scaphoid excision 4 months after the trauma. The result was fair. Figure 4 shows a case seen 33 months after an identical operation performed 3 months after the injury. The movements were painful and there was marked swelling at the wrist. An identical operation performed much later (Fig. 6) slightly improved motion and pain. All these facts favor an early reduction or removal of the non-reducible fragments.

The "mobilization" of the wrist was performed in one case (Figs. 8 to 11). Fascia lata as advised by Putti was used. The hand was kept in the intervals of the massage and movements of fingers and wrist, in an extension to a Thomas' splint for one month, and in a "cock-up" splint for another month. The works of the pioneers in this field are well-condensed in Serra's monograph. The future of these operations is great and the results obtained fully justify their repetition.

PROGNOSIS

Thirty per cent of the cases of the series had met with the carpal injury 4 months to 18 years previously. Diagram III and Figures

5, 6, 7 and 8 are good examples of late cases. It is remarkable how it is possible for these patients to put up with such disabilities which, slight at first, will later lead to a very marked degree of articular invalidity. Usually the upper carpal type of lesion, is of worse omen than the lower. In fact the navicular fracture, on account of being more frequently overlooked, is the cause of great impairment of the functional value of the wrist. The fragments, in our experience, seldom unite, as Downes maintained, in spite of immediate prolonged immobilization for 3 or 4 weeks. However any of the above conditions if seen early and early treated usually leads to no disability at all.

My thanks are due to Lieut.-Col. Tilbury Brown, C.M.G., D.S.O., and to the Council of the Royal College of Surgeons of England for permission to refer to some of these cases and for free access to the material in their Museum.

BIBLIOGRAPHY

Auvray. Gaz. d. hôp., 1898, lxxi, 377.
Beck. Ann. Surg., 1901, xxxiv, 291.
Bizarro. J. Anat., 1921, lv, 256.
Blau. Deutsche Ztschr f. Chir., 1904, lxxii, 444.
Blake. Ann. Surg., 1902, xxxv, 516.
Bolton. Ann. Surg., 1901, xxxiv, 291.
Bryce. J. Anat. & Physiol., 1897, xi, 59.
Caccia. Arch. gén. de chir., 1910, 1010.
Codman and Chase. Ann. Surg., 1905, xli, 321 and 863.
Cotton. Dislocation and Joint Fractures. 1911.
Couteaud. Bull. Soc. de chir., 1906, xxxii, 468.
Delbet. Ibid., 1904, xxx, 949; 1906, xxxii, 484 and 502; 1908, xxxiv, 377.
Destot. Lyon méd., 1904, cii, 106, 199, 373, 529, and 579; 1904, ciii, 347, 402, 1052.
Downes. Ann. Surg., 1908, xlvii, 72, 130.
Eisendrath. Keen's System of Surgery, vol. vii. Philadelphia.
Ely. Ann. Surg., 1903, xxxviii, 97.
Gabaglio. Policlin., 1910, xvii, 365, 381, and 470.
Groves. Lancet. 1909, i, 1714.
Guermonprez. Rev. de chir., 1882, ii, 181.
Guibout. Bull. Soc. Anat., 1847, xxii, 27.
Hessert. Ann. Surg., 1903, xxxvii, 402.
Hildebrandt. Berl. klin. Wchnschr., 1905, lxxvi, 641.
Hunt. Ann. Anat. & Surg., 1881, p. 110.
Jeanne and Mouchet. Presse méd., 1919, lviii, 585.
Johnson. Ann Surg., 1902, xxxv, 1902.
Jones (Sir Robert). Lancet, 1909, i, 1714; Injuries of Joints. London: 1917.
Lesser. Deutsche Ztschr f. Chir., 1902, lxvii, 488.
Lesshaft. Anat. Anzeiger, 1902, xx, 320.
Lilienfeld. Arch. f. klin. chir., 1905, lxxvi, 641.
Marshall. Boston M. & S. J., 1917, clxxvi, 333.
McCarty. Surg. Clin., Chicago, 1919, iii, No. 2, 371.
Moty. Gaz. d. hôp., 1890, lxiii, 634.
Mouchet. Rev. d' orthop., Par., 1914, xxv, 201.
Murphy. The Clinics, 1915, iv, 383.
Nicotra. Chir. d. organi di movimento, 1921, v, 243.
Peste. Bull. de la Soc. anat., 1843, xviii, 170.
Pilcher. Ann. Surg., 1917, lxv, 1.
Pothérat. Bull. Soc. de chir., 1909, xxxv, 765.
Preiser. Zentralbl. f. chir., 1910, xxxvii, 929.
Robert. Ann. de Ther. de Rogn., 1845, 146.
Russ. Ann. Surg., 1905, xli, 265.
Rutherford. Glasgow M. J., 1891, 311.
Schulz. Deutsche Ztschr. f. Chir., 1909, cii, 141.
Scudder. The Treatment of Fractures. Philadelphia: viii, ed. 1915.
Serra. Il trattamento ortopedico delle rigidita. Bologna. 1920.
Serrano. Osteol Humana. 1897, vol. ii.
Skillern and Speese. Internat, Clinics, II, Series 27, 263.
Stimson. Ann. Surg., 1902, xxxv, 574.
Tanton. Le Dentu et Delbet. vol. iv. Paris: 1915.
Todd. Brit. J. S., 1921, ix, 7.
Vialle. Lyon méd., 1904, cii, 315; ibid., 1904, ciii, 394.

MODERN TREATMENT OF CANCER OF THE LIP[1]

By HENRY K. PANCOAST, M.D., PHILADELPHIA
Professor of Roentgenology, University of Pennsylvania

EVER since radiation was first recognized as a possible curative agent against cancer, the surgeon has referred the inoperable and most advanced cases to the radiologist for treatment. Its use was at first regarded as an experimental measure, and, as we must all confess, also a convenience at times. The radiologist accepted such cases and proceeded to do what he could for them. At first the outlook was practically a hopeless one, but even though failure seemed the rule and a result in any way favorable the great exception, and criticism re-echoed the word "failure," the cases continued to be referred, and something had to be done for them. The radiologist did not become discouraged because he realized the possibilities in development of an apparently limitless field for research.

As a result, this branch of medicine has developed more rapidly than any other during the past 20 years. This is due in a large measure to the fact that radioactivity and the production of X-rays have been subjects of unusual interest to the physicist, in whose investigations the radiologist has recognized the solution of many of his problems. Naturally the bonds of mutual interest between the two investigators have grown stronger with years of co-operation. The highly competitive business proposition involved in the manufacture of apparatus has been of great assistance The radiologist is calling upon the pathologist more and more for assistance that will lead to a better understanding of malignancy and the effects produced by radiation. Much knowledge is yet to be gained from investigations by the biologist and therein seems to lie the greatest field for activity in the near future. Co-operation with the surgeon will continue to be sought.

It must be apparent, therefore, that the radiologist is endeavoring by every possible manner of investigation to contrive means of accomplishing what surgery has failed to do. That he has been successful in some measure must be conceded. There is probably more that can yet be accomplished. A large part of the imposed task of successfully treating advanced malignancy must be acknowledged as impossible. It is sometimes difficult to draw the line sharply between the rarely possible and the impossible type of case, but such a line is important in order that the use of radiation treatment may not fall into disrepute in the lay mind. No doubt much of the innate fear of the knife has originated from the attempt of surgery in the past to try what it could not hope to accomplish in the cure of malignancy.

The radiologist probably sees more of the worst wrecks wrought by cancer than anyone else, and when he realizes that each case began in a small way at a period when the lesion, in most instances, could have been readily cured by surgery or by the proper use of non-surgical measures, he is appalled by the now existing general lack of recognition of cancer at its early stages, the failure to treat such cases at the most opportune time, and the apparent disregard of preventive measures that will tend to eliminate recognized exciting causes of cancer in such localities as the lip and buccal cavity. It still seems that the education of the lay mind and the physician to the realization of the importance of recognizing cause and early effect is woefully lacking. How often do we still see the jagged tooth digging into the cancerous area in the tongue or cheek, and even worse, the well-developed epitheliomatous ulcer of the cheek that has been repeatedly stimulated by applications of nitrate of silver.

Radiology has taken up no fight against surgery, nor does it regard surgery in any way as a competitive measure. It has been forced to develop a technique that will in a measure deal successfully with some of the cases in which surgery is impossible, and in doing this, it expects some recognition. Naturally it can, as a rule, deal more success-

[1] Read before the Clinical Congress of American College of Surgeons, Philadelphia, October 26, 1921.

fully with border-line cases than with the more hopeless ones. Having gone so far, we, as radiologists, feel that if we can produce proof of just as successful results as surgery in what have been generally recognized as operable cases in the past, it is our right to treat such cases also. Naturally we shall aim to produce better results than surgery whenever possible, but, above all, the best interests of the patients are always to be uppermost in our minds. Cooperation between the surgeon and radiologist is frequently of paramount importance. Radiology may be employed as an ante-operative procedure in conjunction with surgery, or as a postoperative measure. It is a well-recognized fact that radiation cannot do well in what surgery has tried to do and failed. The recurrent case after operation does not respond as well as the primary case because we have to deal with anatomical, physical, and biological factors that are quite different.

There are three recognized agencies for dealing with cancer at the present time: preventive measures, surgical procedures, and non-surgical methods. Preventive measures are more widely applicable about the mouth than any other locality. Proper attention to the teeth can unquestionably prevent many cases of cancer or precancerous conditions. The regulation of the use of tobacco may help in cases showing a tendency to leucoplakia. When syphilis seems to be a possible factor, antisyphilitic treatment should be pushed energetically, but too much valuable time should not be expended solely on such a measure when the lesion does not appear to respond. Leucoplakia should always be carefully watched and treated if necessary, and cracks and fissures on the lips should not be allowed to persist.

It is not our purpose to discuss surgical measures except from the standpoint of cooperation with non-surgical methods. The non-surgical methods which are now generally recognized as applicable in the treatment of lip and mouth cancer and its metastasis are the use of radium, the X-rays and electrothermic coagulation, or possibly the actual cautery. In many instances all of these agents must be combined, and frequently with surgery. In comparatively few instances is any one of them employed alone.

Cancers involving the regions designated may be roughly grouped into lesions involving the lower lip and corner of the mouth, the tongue, primary lesions in the floor of the mouth, the tonsil, and in the mucous membrane covering the cheeks, the alveolar processes, the palate and pillars. The disease in each of these anatomical structures requires separate consideration. Mainly for obvious anatomic reasons the upper lip is not included except when the disease involves the portion near the corner of the mouth. From the standpoint of a radiologist, the essential purpose of this paper must of necessity be the presentation of the present status of non-surgical methods of treatment.

THE LOWER LIP

The radiologist is probably not so much concerned as he should be in distinguishing between epidermoid and basal cell cancer of the lip. He realizes what the worst outcome may be and treats all cases with that idea in mind. He sees too often the results of direct surgical trauma to cancerous tissue and is loath to satisfy his curiosity by pathological proof of the cellular characteristics of a lesion unless certain that the removal of a specimen is absolutely safe.

Theoretically, lip cancer should be readily cured by surgery because both the primary and metastatic lesions are easily accessible, but this is not the result practically, mainly because surgery does not always remove all the cancer and a large number of cases are not seen sufficiently early. Surgical results would be ideal if some means of education could inculcate in the mind of every individual that every ulcer, fissure, or keratosis of the lip persisting for several weeks, especially if showing induration, and if syphilis be excluded, is either cancerous or potentially cancerous, and that such an area should be removed. The vast majority of lip cancers have, unfortunately, gone beyond this stage when first seen. The general run of cases as we see them may be divided into three groups, from the standpoint of methods of

treatment, prognosis, and statistics, as follows: primary lesions without any evidence of metastasis; cases presenting small palpable nodes in the submental or submaxillary triangles; and those with advanced primary lesion and large nodes in these areas or in other gland groups. The greatest danger from cancer of the lower lip is metastasis, which, if it has occurred, increases the death rate very considerably. In view of the frequency of metastasis every one who treats such cases by any method should have an intimate knowledge of the lymphatic drainage from the lip. Lymph vessels pass directly downward from the central portion to the glands in the submental triangle, and from the lateral portions to glands in the submaxillary triangles. The submaxillary salivary glands are well surrounded by lymphatics. If there is blockage in the lymphatics of one side from cancer or some inflammatory process, the free anastomosis with the opposite side readily permits metastasis to pass from one side to the other. After involvement of these groups of lymphatics, metastasis may proceed to others in the neck.

In the first group of cases, without palpable nodes in the neck, the results of surgery are good. Metastasis without palpable evidence is likely to be present in a certain percentage of these cases, however, and surgery alone cannot be complete without including the removal of all glands in the submental and submaxillary triangles. Broders[1] in 1920 presented statistics on 449 cases operated upon at the Mayo Clinic and in which lymph nodes were removed, and metastasis was found in 23.38 per cent. At best, the results of surgery are little more than 90 per cent of cures after 5 years. Sistrunk[2] in a recent communication presented statistics of cases of cancer of the lower lip operated upon at the Mayo Clinic during 1912, 1913, 1914. Of 93 complete cases in which the primary lesion was excised and glands in the triangles removed and found not involved, 90.3 per cent were living 5 to 8 years after operation. In eleven of these local recurrences were subsequently removed and there were three recurrences in neck glands.

The striking feature in these and many other statistics is the frequency of local recurrence, which indicates an incomplete removal of the primary lesion, leaving *in situ* cancer cells which have ample time to cause metastasis while the recurrence is developing to discoverable proportions. Obviously the results should be better, and surgery alone cannot be regarded as a complete method of treatment in view of our present knowledge of the effects of radiation. Many surgeons are satisfied to employ it as a postoperative measure. The wisdom of this is not borne out either by results or by scientific knowledge of the effects of radiation. It is our firm belief that every case should have at least a preliminary application of radiation before any attempt at removal of the primary lesion or lymph glands is attempted. We have not advocated non-surgical measures alone until a technique was developed which we believed was safe and certain of results. Too few cases have passed the five year period to make our statistics of value, but we are well satisfied so far with the results we have obtained.

Our technique comprises a preliminary radiation of the area of the primary lesion and well beyond all apparent evidences of involvement by radium. Cross firing is practiced as far as is possible, and we aim to produce a severe reaction. At the same time the region of lymphatic drainage is well radiated by radium, across the face from the level of the posterior aspect of one submaxillary salivary gland to the same point on the opposite side. A full dose of X-rays is then given over each side of the neck, and as the submental and submaxillary triangles are not apt to receive their full share of the dosage because of the protection of the mandible, these areas are given an additional dose of radium. This additional dose of radium produces a severe but not dangerous reaction. If the case is being thus prepared for the surgeon, we advocate waiting for the reaction to have reached its

[1] Broders. Squamous-cell epithelioma of the lip. J. Am. M. Ass., LXXV, 650.

[2] Sistrunk, W. E. The results of surgical treatment of epithelioma of the lip. Ann. Surg., 1921, May, p. 521.

maximum and to subside slightly before operation, in order that the maximum effect upon the lymphatic channels as well as cancer cells may be brought about. If the case does not come from the surgeon, we proceed immediately to destroy the primary lesion by electrothermic coagulation, for two reasons: to obtain the added advantage of heat and to relieve the patient of the discomfort resulting from the severe radiation of the primary lesion. When a large mass of tissue is thus removed, there is some danger from secondary hemorrhage when the slough separates, and the patient is instructed how to stop the bleeding by pressure. Patients suffer little or no pain and there is only the annoyance from the sloughing process. Healing is complete in 2 weeks to a month. Usually there is insufficient deformity to require subsequent plastic surgery. As this procedure does not entail possible surgical trauma to cancerous tissue we do not fear the possibility of metastasis appearing later. The radiation of the neck is repeated once or twice at subsequent periods.

In dealing with cases belonging to the second group, we have practically discontinued giving postoperative radiation, unless it is employed as an anteoperative measure as well as the results do not warrant its use. Cancer tissue once directly traumatized by surgery without a complete removal and without previous radiation does not respond well to any form of treatment, and all too frequently upon the radiologist is laid the blame for inefficacy of radiation. If we are expected to treat cases at all, we should surely be accorded the privilege of directing that treatment along such lines as our experience shows to be the most effectual. The technique we now employ in cases belonging to the second group deals with the primary lesion, lymph-channel areas, and glandular regions in exactly the same way as in the first group, with destruction of the primary lesion by electrothermic coagulation. If the enlarged glands do not subside or do not diminish with reasonable rapidity, we may either try radium implantation or refer the case for block dissection, in which case we may regard the treatment already given as an anteoperative procedure. If the case is referred to us by a surgeon, the anteoperative treatment is given in the same manner as for group one cases, and the case is then referred back for excision and block dissection as soon as the reaction has subsided somewhat. It is then referred to us subsequently for postoperative treatment.

In this connection we are quite in accord with the procedure advocated by Quick[1] of embedding emanation tubes in the operative wound at all suspicious areas, and especially where lymph channels have been cut or cancer tissue has inadvertantly or of necessity been cut into and not removed in entirety. The resulting slow radiation and intense local but not far reaching reaction from β-radiation must certainly be efficacious, and entails no danger to the flap if the emanation seeds are well covered. One must use care in giving postoperative radiation following this procedure. We have not had the opportunity of following this technique because of the lack of an emanation plant at our disposal. The frequently flaunted objection of anteoperative radiation making the operation more difficult seems to be without good foundation, according to the statements of those who employ both radiation and surgery, especially if the operation is not performed at the time of the reaction.

We do not wish to go on record for the origin of a broad statement to the effect that cases of cancer of the lower lip, without metastasis or with early metastasis can be handled satisfactorily by non-surgical methods, for the reason that such a broad statement is subject to too much latitude in its interpretation. We do believe, however, that such cases can be handled in a perfectly satisfactory manner by non-surgical methods alone or in conjunction with surgery, but we absolutely insist that the technique carried out must be one similar to the one we have advocated, and that each procedure must be rigidly carried out to the most minute detail.

Cases belonging to the third group, with advanced primary lesion and extensive gland-

[1] Quick, Douglas. The conservative treatment of cervical lymphatics in intra-oral carcinoma. J. Am. M. Ass., 1921, Aug. 6.

ular metastases comprise an unfortunate class of mortals whom no one cares to handle. They usually fall to the lot of the radiologist to treat. The choice between surgeon and radiologist is practically one between two evils. Surgery cannot help, and usually makes matters worse. Radiation usually can do no better but is preferable. Implantation of radium into glandular metastases that have usually infiltrated through gland capsules is practically an imperative part of the procedure of radiation.

RADIUM TREATMENT OF MYOMA OF THE UTERUS AND MYOPATHIC BLEEDING

Final Results in One Hundred Eighty-Three Cases[1]

By C. JEFF MILLER, M.D., F.A.C.S., New Orleans

NO abdominal operation has reached a higher degree of technical perfection or given more satisfactory postoperative results than hysterectomy as usually performed for myoma of the uterus. It is generally conceded that the results, both primary and secondary, hardly permit of improvement. For these reasons it is difficult to convince the surgeon that any other method of dealing with myoma of the uterus and and hæmorrhage of myopathic origin can compete with the already standardized surgical procedures. Any other method of treatment must present properties rarely possessed by a therapeutic agent, and the results obtained by such a remedial agent must show that the relief is permanent, and that its use is safer than operation and gives a higher percentage of preservation of physiological function than an operation performed by a skillful surgeon.

That we possess in radium such a therapeutic agent, and that it will eventually supplant surgery in a large percentage of cases now treated by hysterectomy, I propose to prove by submitting the final results obtained in 183 cases treated with radium and observed over a period of 7 years. Between May, 1914, and July, 1921, 230 cases were treated by radiation, but satisfactory follow-up records are available in only 183 cases. It is useless to dwell upon the effects of radium, or the primary clinical results, since these phases of the subject are already definitely established, and about them there is little doubt. These records are of value chiefly because of the time that has elapsed since the treatment was instituted.

Since it may be inferred that I am overenthusiastic in regard to the use of radium, I would make this point clear in the beginning by stating that during the same period of time which this report covers nearly an equal number of cases have been treated surgically. Thus it can be clearly shown that I appreciate the limitations of radiation, and am by no means insistent that it can supplant surgery in all cases of myoma of the uterus or essential hæmorrhage. The age of the patient, the type and social situation, as well as the size of the tumor, the condition of the appendages, the evidence of previous infection, and the general condition of the patient, are all factors to be carefully weighed in determining the most satisfactory method of treatment.

Surgery is unquestionably the procedure of choice in young women who present definite growths causing excessive bleeding, submucous growths, or cases in which suspicion exists of malignancy of the fundus of the uterus. In these types of cases conservative surgery is decidedly less radical; this is a point that cannot be too strongly emphasized. In order to induce shrinkage or disappearance of a myoma, it is necessary to produce at least a temporary cessation of menstruation, and the dosage of radiation has not yet been so

[1] Read at Southern Surgical Association, Pinehurst, North Carolina, December, 1921.

controlled that a temporary suppression can be foretold with the degree of accuracy necessary for justifying its use when conservation of function is of primary importance. Therefore, in young women, when definite single tumors are present, the patient should be persuaded that operation offers a chance for myomectomy, with preservation of the physiological functions. In small multiple growths, when it can be definitely established beforehand that hysterectomy is necessary, radium should be adopted as the method of choice.

The most striking feature revealed in a review of both series of cases, those treated by radium and those treated by surgical intervention, is the increasing percentage of myomectomies performed, where formerly hysterectomy would have been done. The prevalent idea that myomectomy is attended with a high mortality and that second operations are necessary in too large a percentage of cases to warrant conservatism is not borne out by the results obtained by competent surgeons. The decision to resort to myomectomy in many cases which would have been subjects for hysterectomy formerly was prompted by the assurance that if myomectomy failed to control the hæmorrhage or check the menstrual disorders, radium would complete the cure without further surgical interference. With such assurance, the scope of conservative surgery has been materially widened, a larger number permanently relieved, and the percentage of subsequent pregnancies has further justified the decision.

Large myomata should be treated by myomectomy or hysterectomy. Unless some contra-indication to operation exists, there is no valid reason for the use of radium in large tumors. Massive growths too often present serious complications such as adhesions, salpingitis, degenerative changes, and pressure symptoms, to prompt the surgeon to depend upon radiation as the method of election.

Radiation has, however, a distinctive application in this group in that it will promptly control the hæmorrhage until such time as the consequent improvement in the patient's general condition will render her a safe operative risk. Radium is a valuable adjunct to surgery in this group, but it should seldom be the elective treatment in myomata larger than a three and a half months pregnant uterus. Upon this point the majority of observers generally agree, large growths only partially shrink, and the period of treatment extends over too long a time to satisfy either the physician or the patient. Therefore, in cases of this group radium should be used only in exceptional instances.

One hundred and seven of the 183 cases of this series presented myomata varying in size from small tumors detected during the course of diagnostic curettage to ascertain the cause of bleeding, to massive growths extending above the umbilicus. There were only a few of the latter group treated, and practically all of them presented contra-indications to operation. The ideal type for treatment with radium is the small or moderate sized interstitial myoma. The primary result is uniformly prompt, and recession in the size of the growth, while variable, is sure. The diminution is usually more than 50 per cent. The growth is frequently reduced to a negligible affair, and often entirely disappears.

Submucous growths, while responsive to radiation, should be selected with extreme care, owing to their known tendency to infection and sloughing after intra-uterine manipulations. In our series two of the earlier cases of this type developed pyometra, and one of them eventually required a hysterectomy. The size of subperitoneal growths is influenced least of all, and it has also been noted that radium has less effect in reducing the size of myomata in women beyond the menopause. Our best results appear to have been obtained in women presenting a history of severe menorrhagia.

It is apropos to mention here the technique followed in the application of the radium. Preliminary curettage should precede the application in order to permit a careful bimanual examination under anæsthesia, to eliminate small polypi, and to provide for a microscopic examination of the uterine scrapings.

The radium is introduced into the cavity of the uterus screened by brass and rubber or frequently a celluloid capsule, and is left *in*

situ from 3 to 24 hours, according to the indications. The average time of exposure in our series in young women—those under 38 years of age—was 12 hours in cases of myomata. In women beyond this age, where it was not so important to preserve menstruation, the treatment lasted 24 hours. As a rule, 50 milligrams of the radium element was employed. This dosage produced permanent cessation of menstruation in women over 40 years of age in 94 per cent of the cases. In our earlier work a second exposure was made within 10 days or 2 weeks, but it was soon observed that this was unnecessary, and often caused discomfort that was persistent, and occasionally very distressing.

At present we believe that one application is sufficient, and that subsequent exposures should be given only as indications develop. The recession in the size of the growth may be surprisingly rapid, or it may be gradual. Again, the growth may appear unaffected for several months, and then suddenly show a rapid shrinkage. For this reason, repeated exposures should be cautiously advised, and repeated examinations should be made to check the status of the tumor. Lately we have preferred to make 15-hour exposures, and to repeat the application in 3 or 4 months if it is necessary. We have found that, even after reducing the exposure, the single application is usually sufficient. This permits of its use in younger women, since our experience has shown that in many cases menstruation will reappear in several months, or as late as 2 years, and continue normal thereafter. Furthermore, the menopausal symptoms are apparently less marked when the shorter exposures are employed.

One hundred and two of the 107 cases reported complete relief from hæmorrhage within 5 months after radiation. Two of the remaining five required a second application before being relieved. Two others were not relieved by a second exposure, and the remaining case was eventually subjected to hysterectomy in another clinic. These figures practically correspond with the results obtained by other observers, and prove conclusively that no other agent at our disposal equals radium in controlling excessive uterine bleeding.

It has already been mentioned that the effect on the size of the tumor is variable. Fifty-seven cases returned within 5 years for other conditions, or for examination. In 37 of these the growth could not be determined at the subsequent examination, or was so reduced as to be classed as negligible. In two instances massive growths, as large as a 7 months' pregnant uterus, had shrunk below the umbilicus. Radium had been used in order to control bleeding because these patients were temporarily bad surgical risks. Both were sufficiently improved by the treatment to permit of successful operation at a later date. Reports were obtained from the balance of the series either directly from the family physician, or from the patients, who reported the findings of their medical attendants, and these records practically correspond with those in the cases under my personal observation.

In outlining the limitations of radium, too much stress cannot be placed upon eliminating chronic pelvic infection. Latent infection is so prone to be fanned into activity by radiation that no case is selected for this treatment when doubt exists as to its presence. In four cases in this series, all of which occurred in our earlier work, this truth was not appreciated. In two cases pelvic suppuration followed, requiring vaginal drainage; one required a hysterectomy after a prolonged siege of pelvic peritonitis; and the fourth case was an invalid over a period of several months.

It was further noted that patients who complained of pain associated with myomata were not usually relieved of that symptom even when bleeding was controlled, and the tumor partially reduced by radiation. This symptom is frequently attributed to pressure, but certainly pressure cannot always be the cause, else the pain would disappear as shrinkage occurs. This has happened so often that now we usually advise the patient that the bleeding will cease, the tumor may shrink, but that we cannot promise that the pain will be relieved.

Seventy-six of the 183 cases were instances of myopathic hæmorrhage such as are commonly classified as chronic metritis, hyperplasia,

fibrosis, uterine insufficiency, and so forth, conditions most frequent in women approaching the menopause. In this type, radium more nearly approaches the ideal specific than any therapeutic agent at our command. Formerly, hysterectomy was the only satisfactory method of dealing with these conditions. At present it may be stated without exception that the surgeon who advises hysterectomy in uncomplicated cases of this group, when radium is available, is hardly acting in the best interests of his patient.

Fifty-eight cases of this last group were between the ages of 38 and 54 years. More than half had been subjected to all the measures usually employed, except hysterectomy. All received practically the same dosage, viz., a 24 hour exposure from a tube containing 50 milligrams of the radium element, as all of them had arrived at the age when it was not essential to preserve the physiological function. Four of them required a second application within 2 years for recurrent hæmorrhage, and were eventually cured.

Eighteen cases were between 15 and 36 years of age, 5 of them being between 15 and 18. The five instances of severe hæmorrhage in the women between 15 and 18 are of special interest. All had been treated by rest, tonics, glandular extracts, and repeated curettage without relief, and the hæmorrhage was so severe in one case that preparations had been made for transfusion. Three to 8 hour exposures with 25 milligrams of the radium element produced a temporary amenorrhœa, and menstruation was re-established in all cases within 14 months. In four cases it was perfectly normal. Since we do not know the ultimate effect of radium on the ovarian structures, it should be used only as a last resort in women of this age. In the cases reported it was used only after every other measure had failed to give relief, and the final results were a signal triumph for radiation.

Of 18 cases under 35, in which it was desirous of controlling bleeding without producing permanent cessation of menstruation, radium was applied from 8 to 12 hours until from 200 to 800 milligram-hour exposures were given. Six ceased to menstruate promptly; 4 of these reported a return in 1 year, which in one case was quite profuse; in the other cases it was perfectly normal. Five cases continued to menstruate scantily, the flow lasting the normal duration of previous periods. In four instances the flow was reduced and remained regular. Three cases menstruated irregularly, reporting scanty periods every 2 or 3 months.

Three pregnancies were reported in the series. One woman was delivered of a premature healthy baby at 8 months. The second case aborted at the fourth month. The third case is now 8 months advanced in pregnancy. An interesting feature of the cases of pregnancy is that in two instances there had been a period of sterility preceding the treatment, in one case of 3 years, in the other of 8.

When it was desirous of controlling bleeding in women over 40 years of age and full dosage was used, immediate cessation of menstruation followed in 20 per cent of the cases. Sixty per cent menstruated once, 15 per cent menstruated irregularly, and the balance reported no relief and have since returned for a second treatment. The second treatment was successful in all but three instances, and two of these three were relieved by a third exposure.

Profuse leucorrhœa was noted in about 20 per cent of the cases, and a slight but persistent discharge was reported in 30 per cent. In about 40 per cent it was absent, or was so slight as to cause no comment. Not infrequently radium cured or markedly diminished a leucorrhœa which was present before its application. The leucorrhœa as a rule rarely lasted longer than 6 or 8 weeks, but in several instances it was persistent after a year.

A few of the patients were operated upon subsequent to radiation. Four of them had radium preliminary to operation in order to improve their status as surgical risks. Two developed pyosalpinx and both required hysterectomy. Two continued to complain of pain and submitted to operation for relief. Two others became discouraged and submitted to operation before sufficient time had elapsed to test the effects of radium.

Subsequent reports as to the menopausal symptoms are interesting. In women over

40, in whom preservation of function was not considered important, about 60 per cent reported flushes and the usual phenomena of the climacterium. In about 20 per cent the symptoms were reported as severe, and almost invariably these cases had given a history of bleeding of the aggravated type. The duration of symptoms lasted about the time of the normal menopause, but in two cases the flushes were very severe and have persisted for 6 years. The patients in their latest reports state that the flushes are as frequent and as severe as they were during the first 4 months following radiation.

This brief review of cases extending over a period of 7 years reasonably warrants the conclusion that a large percentage of the cases of myoma of the uterus formerly subjected to operation can be permanently and safely relieved by radium, and that practically all cases of uncomplicated essential hæmorrhage can be cured by radium.

CRANIAL NERVE PALSIES PRODUCED BY TUMORS IN THE REGION OF THE JUGULAR FORAMEN

By WILLIAM O. OTT, M.D., Rochester, Minnesota
Section on Neurologic Surgery, Mayo Clinic

THREE cases of unilateral paralysis of the larynx with involvement of the last four cranial nerves of the same side were selected to report because the paralysis in all of them was due to extracranial tumors. In two cases the paralysis was due to tumors arising from the deep portion of the parotid gland in the retromandibular fossa, and in one case to a lesion in the region of the jugular foramen, the exact nature of which is not known. A tumor was removed by operation in one case only (Case 285410).

Case 1 (285410). Mr. A. W., age 35, came to the Mayo Clinic, August 21, 1919, because of deafness in the right ear. On examination polyps in the right ear and a small mass below the ear were found. The polyps were removed and radium was applied to the mass.

The patient returned to the Clinic October, 1920. He was still deaf and often during 15 months had had dull pain below the right ear. For 8 months he had had headaches in the right temporal region extending down below the ear, and paræsthesia of the right side of the tongue. For one year he had been unable to swallow dry food. He had been hoarse for 10 weeks.

Examination revealed the right cord to be fixed, and a collection of mucus in the right pyriform fossa. On further examination the right pupil was found to be somewhat smaller than the left, and the reflexes and fundi negative. There was almost complete motor paralysis of the right half of the soft palate; the right vocal cord was paralyzed and the voice hoarse and nasal. There was moderate paresis of the right sternomastoid muscle, atrophy and fibrillary tremor of the right trapezius muscle, and fibrillary twitchings and slight atrophy and paralysis of the right half of the tongue. A diagnosis was made of paralysis of the ninth, tenth, eleventh, and twelfth cranial nerves with partial paralysis of the sympathetic nerve, due to a tumor in the retromandibular space.

November 13, 1920, operation was performed (Adson). The tumor was removed by the technique described herein. The patient recovered uneventfully except for slight weakness of the right facial nerve which was injured during the operation. In a report 10 months after operation the patient stated that his voice and the ability to swallow had improved somewhat, but the right half of his tongue was still paralyzed.

Case 2 (348444). Mrs. N. B., age 42, came to the Clinic February 3, 1921. She had had ulcer of the stomach 15 years before; a gastro-enterostomy had been performed in 1915 with partial relief of symptoms. She had had migraine with attacks of vomiting and vertigo for about 28 years. For the last 8 years she had been partially unconscious during attacks, probably migraine syndrome. For the last 6 years she had had attacks of choking and coughing; these had been much worse the last 2 years; occasionally while talking she had a catching sensation in her throat. Her voice was husky and at times lost. The right side of her tongue had felt thick and stiff for about 18 months.

Examination revealed slight enlargement of the heart to the left with systolic murmur transmitted

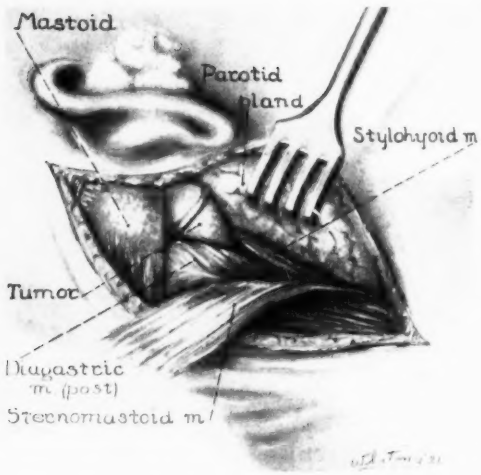


Fig. 1. Tumor after the sternomastoid had been reflected and before the mastoid process, stylohyoid, and posterior belly of the diagastric had been reflected.

to the axilla. Examination of the ear was negative. Examination of the blood revealed secondary anæmia; the hæmoglobin was 30 per cent; the erythrocytes were 3,170,000, the leucocytes 5,800; the differential count was normal. The Wassermann reactions on the blood and the spinal fluid were negative. Roentgenograms of the chest revealed thickened pleura at the right base. Between the angle of the right jaw and the mastoid process was a hard fixed mass. The pharyngeal wall bulged slightly inward posterior to the tonsil on the right. The patient coughed on pressure on the external tumor. Further examination revealed ptosis of the right eyelid, the right pupil smaller than the left, diminished reflex to touch on the right soft palate, partial motor paralysis of the soft palate and pharyngeal muscles, and paralysis and marked atrophy of the right side of the tongue. Speech was slurred and dysarthric. The right vocal cord was completely fixed. There was marked anæsthesia over the right half of the soft palate, right pharynx, and larynx. Practically all deep reflexes were increased.

A diagnosis was made of tumor in the region of the jugular foramen, and paralysis involving the ninth, tenth, twelfth, and probably the eleventh nerves. On account of the anæmia and the poor condition of the patient, radium treatments were given. The patient, in a report seven months after her visit to the Clinic, states that she is somewhat improved but that the tumor is still present.

Case 3 (361632). Mrs. G. L., age 40, registered at the Clinic June 15, 1921. Seven years before, following the birth of her last child, she noticed slight difficulty in swallowing; this gradually increased and then improved. Six years before she had had occasional occipital headaches. Four years before she had become hoarse and had noticed wasting of the right shoulder and moderate aching of the right side of the neck and back. One year before her tongue had begun to feel thick and troubled her in speaking. All of her teeth had been removed recently.

The general physical examination, the Wassermann reaction on the blood, and the roentgenograms of the cervical spine were negative. Further examination revealed the pupils, the fundi, and hearing to be normal. The right soft palate was atrophied and paralyzed, the pharynx on the right side was anæsthetic. The right sternomastoid and the trapezius muscles were atrophied; the right side of the tongue was atrophied and paralyzed, and the serratus magnus and suprascapular and infrascapular muscles on the right side were atrophied and partially paralyzed. There was a questionable mass in the region below the ear posterior to the ascending ramus of the jaw.

A diagnosis was made of incomplete paralysis of the ninth, tenth, eleventh, and twelfth nerves on the right side and partial atrophy of the supraspinati and infraspinati on the right side, and a lesion in the region of the right jugular foramen. Because of the length of time symptoms had been present, and the questionable tumor, it was thought inadvisable to explore at this time and radium was applied over the region of the tumor. The patien was dismissed to be observed by her home physician. A report from her October 1 stated that there was no change in her condition.

The recognition of unilateral associated laryngeal paralysis dates from Jackson's first description, in 1864, and since then the condition associated with paralysis of the soft palate and tongue on the same side has been described as Jackson's syndrome. In 1891, Avellis described a group of cases presenting the syndrome of palatolaryngeal hemiplegia. In 1897, Schmidt described still another combination of paralyses associated with laryngeal hemiplegia. Vernet recently called attention to a combination of unilateral paralysis of the three nerves passing through the posterior lacerated foramen. Collet reported unilateral extracranial paralysis of the last four cranial nerves resulting from injuries. Numerous combinations of unilateral paralysis of the larynx, associated with paralysis of one or more of the last four cranial nerves, may be encountered. Some of these have become classic.

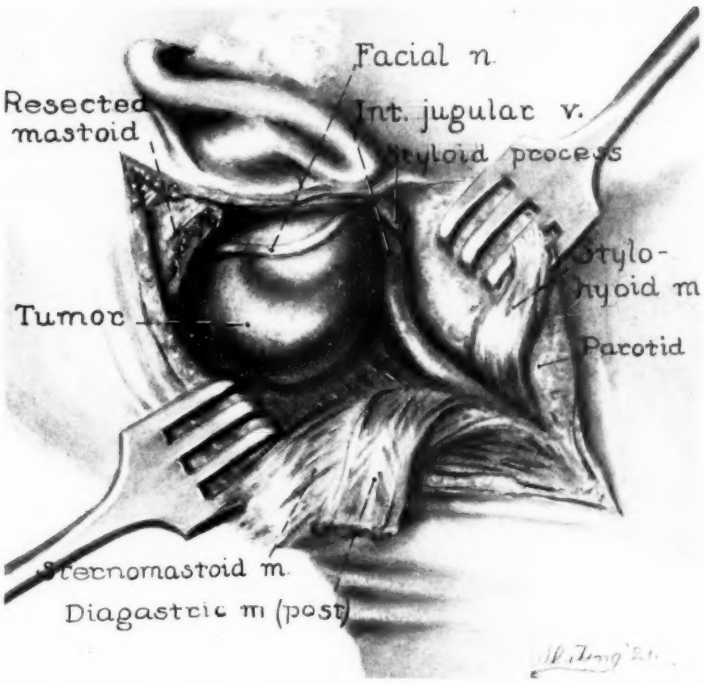


Fig. 2. The tumor after part of the mastoid process, petrous portion of the temporal bone below the auditory canal have been rongueered away and the stylohyoid and posterior belly of the diagastric muscles reflected.

CLASSIC SYNDROMES

	Hemiplegia of larynx	Hemiplegia of soft palate	Hemiplegia of tongue	Hemiplegia of sternomastoid and trapezius
Syndrome of Avellis	+	+	−	−
Syndrome of Schmidt	+	+	−	+
Syndrome of Jackson	+	+	+	−
Syndrome of Topia	+	−	+	−
Total syndrome (Collet) of last four cranial nerves	+	+	+	+

In Case 1 the last four cranial nerves were involved. Case 2 was similar to Case 1, but the external branch of the spinal accessory nerve was apparently not involved. In Case 3 the last four cranial nerves on the right side were paralyzed, and there was slight atrophy and weakness of the serratus magnus and supraspinatus and infraspinatus muscles on the right side.

It is often difficult to make a diagnosis, and at times it is impossible to differentiate the extracranial lesions of the last four cranial nerves from bulbar or intracranial lesions, but usually in cases of intracranial lesions other symptoms referable to involvement of part of the cerebrospinal nervous system, such as hemianæsthesia, hemiparesis, and hemiataxia are present.

The exact nature of the lesion in many cases reported under Avellis', Schmidt's, and Jackson's syndromes is doubtful, since in many instances the diagnosis was not verified by operation or necropsy. Some of the verified extracranial lesions which produced unilateral associated laryngeal paralysis were due to aneurisms in the region of the jugular foramen, causing paralysis of the last four cranial nerves. One case was probably the result of tuberculous glands in the retromandibular fossa, producing the syndrome of the posterior lacerated foramen. Many cases were due to trauma, stab wounds, and

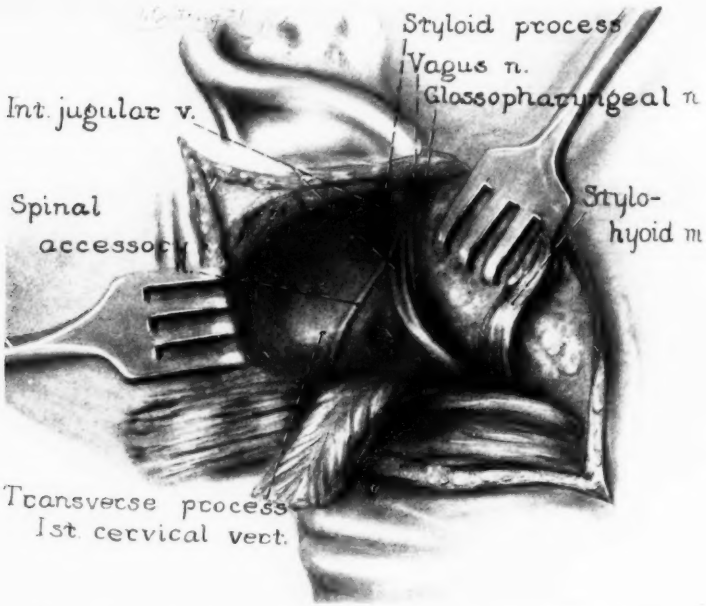


Fig. 3. The bed of the tumor with the nerves and jugular vein on which pressure had been made by the tumor.

gunshot wounds in the region of the base of the skull, while others were due to inflammations, nasopharyngeal neoplasms, and syphilitic extracranial lesions. I was unable to find a report of such cranial nerve palsies caused by tumors of the parotid.

TECHNIQUE OF OPERATION

The method of exposing the region of the jugular foramen in Case 1 was as follows: An incision was made along the anterior border of the sternomastoid muscle, extending well up along the anterior border of the mastoid process. By retracting the anterior border of the sternomastoid backward and by dissecting forward, a well-encapsulated tumor was exposed posterior and medial to the ascending ramus of the jaw, and anterior and medial to the mastoid process below the lower bony wall of the external auditory canal and medial to the stylohyoid and posterior belly of the diagastric muscles (Fig. 1). The mastoid process was ronguered away together with part of the temporal bone below the auditory canal. The bellies of the stylohyoid muscle and of the diagastric muscle were divided and reflected in order to obtain exposure (Fig. 2). Posteriorly the tumor was in contact with the transverse process of the atlas; it arose apparently from the deep portion of the parotid gland. The ascending ramus of the jaw anteriorly and laterally, and the mastoid process posteriorly, prevented the tumor from bulging outward in its growth, and as a result it pressed against the structures that pass through the jugular foramen (Fig. 3). The tumor was removed by careful dissection, with the capsule intact, except a small projection which extended up through the jugular foramen along the jugular vein. This part was curetted away, and the entire cavity packed with gauze saturated in Harrington's solution. Pathological examination of the tumor revealed mixed tumor of the parotid.

SUMMARY

In the three cases described, cranial nerve palsies resulted from tumors in the region of the jugular foramen. In two of the cases the

tumor arose from the deep portion of the parotid gland and in enlarging, extended to the region of the jugular foramen. Attention is directed to the fact that extracranial tumors or other lesions in the region of the jugular foramen are accessible and may be removed surgically. If the tumors are of the mixed parotid type, they are encapsulated in the early stages, and during this stage surgical removal is the best method of treatment.

BIBLIOGRAPHY

1. Avellis, G. Klinische Beitraege zur halbseitigen Kehlkopflachmung. Berl. Klin., 1891, xl, 1-26.
2. Bruzzone, C. Linfomi cervicali profondi e sindrome del foro lacero posteriore. Riforma med., 1921, xxxvii, 364-376.
3. Collet. Sur un nouveau syndrome paralytique pharyngo-larynge par blessure de guerre. (Hémiplégie glasso-laryngo-scapulo-pharyngée). Lyon méd., 1915, cxxiv, 121-129.
4. Jackson, J. H. Paralysis of tongue, palate, and vocal cord—Treatment of obscure forms of metrorrhagia. Lancet, 1886, i, 689-690.
5. Lannois and Bourcart. Un nouveau cas de paralysies multiples des nerfs craniens. Lyon méd., 1917, cxxvi, 41-42.
6. Lannois and Jouty. Un cas d'hemiplégie des quatre derniers nerfs craniens. Lyon méd., 1917, cxxvi, 424-426.
7. Lannois, Sargnon, and Vernet. Sur le "syndrome total" des quatre derniers nerfs craniens (deux observations nouvelles de blesses de guerre). Rev. neurol., 1916, xxiii, I, 943-948.
8. Mackenzie, S. Cases of intracranial disease involving the medulla oblongata. Brit. M. J., 1883, i, 408-410.
9. Schmidt, M. Die Krankheiten der oberen Luftwege. Berlin: Springer, 1894, xii, 729 pp.
10. Vernet, M. Sur le syndrome des quatre dernières paires craniennes, d'après une observation personnelle chez un blessé de guerre. Bull. et mém. Soc. méd. d. hôp. de Par., 1916, xl, 210-223.
11. Vernet, M. Syndrome du trou déchiré postérieur (paralysie des nerfs glosso pharyngien-pneumogastrique-spinal). Rev. neurol., 1918, xxxiv, 117-151.

CONGENITAL MEGACOLON IN ADULT

By W. FRANK FOWLER, M.D., S. C. DAVIDSON, M.D., and RALPH R. MELLON, M.Sc., M.D., D.P.H., Rochester, New York

THE occurrence of the so-called idiopathic dilatation of the colon in childhood is not exceedingly rare, but a well-authenticated case of congenital megacolon in the adult is sufficiently unusual to merit description.

Mr. A. F., age 26, had been obstinately constipated since birth. Enemata became gradually less effectual. Recently the bowel has been emptied by a physician at intervals of 3 or 4 months, when severe abdominal cramps demanded relief. A general feeling of "heaviness" and a tired feeling in the legs preceded the cramps. Twice he has been compelled to have his rectum unpacked in a hospital; the absence of subjective symptoms was remarkable; the family history as regards similar trouble was negative. He was a fairly well-nourished young man, apparently of low mentality; pallor was marked; his tongue was heavily coated, and his breath foul. Inspection revealed prominence of the entire left half of the abdomen; here, the percussion note was dull, elsewhere it was tympanitic, although the abdominal walls were flaccid. A rounded, solid, painless mass could be palpated in the left upper quadrant. Physical examination was otherwise negative.

The X-ray examination by one of us (Davidson), revealed chest and œsophagus, normal. Stomach apparently hypertonic in type, and appears turned upon itself in such a manner that the lower border is represented by the concave lesser curvature, and the upper border by the convex greater curvature. There is nothing to indicate any irregularity in outline of either the lesser or greater curvature. Pylorus, normal location; its outline is not distinctly observed. Duodenum, normal.

Four-hour examination shows no gastric retention. Twenty-four hour examination shows all the ingested barium in the ascending colon on the right side. The colon itself, in this region, appears somewhat elongated, but not dilated. The cæcum appears regular in outline. A small appendix is outlined.

Forty-eight-hour examination shows no change in the position of the barium. Clysma: 2½ quarts of solution were allowed to flow into the rectum. The outline of normal colon is not observed. The clysma solution drops into what appears to be a bag, which seems to fill the entire abdominal cavity. This pouch or bag appears regular in outline, except at one point on either side, where there appears a slight indentation. This pouch seems to have no connection with the ascending colon, since none of

the clysma solution seems to enter the ascending colon directly from the pouch. The ascending colon retains the same outline that was observed during the previous examination.

The rectum, which seems to be only about one-half the normal length, is directly continuous with this large pouch.

Operation August 6, 1921. Through a left rectus incision, an enormously distended loop of bowel was delivered with some difficulty from beneath the diaphragm. It proved to be the redundant sigmoid. The dilatation and hypertrophy extended downward, involving the rectum, and upward along the descending colon. At the lowest accessible point where section was made, the rectum approximated 7 inches in its flattened diameter. Two clamps above, and two below, were required for occlusion. Division was made with the Percy cautery. The diameter of the rectum and the thickness of its walls complicated closure. The withdrawal of the two clamps during traction upon the inverting suture proved an awkward procedure, and slight leakage occurred. The proximal section was made through the normal descending colon. A colostomy was placed slightly below the level of the umbilicus, in the upper third of the incision. (Re-establishment of the intestinal continuity will be undertaken later.)

Convalescence was uninterrupted, save by the slow healing, due, apparently, to fæcal contamination of the incision. The improvement in mentality was immediate and astonishing.

Examination of gross specimen. The excised bowel was dull white in color and of the consistency of leather; weight 3900 grams; circumference 47.5 centimeters in middle; length of enlarged portion 40 centimeters; entire specimen 60 centimeters; circumference at lower cut end, 36 centimeters (entire dilated portion could not be removed); capacity after fixation 2250 cubic centimeters; estimation of original capacity, 2880 cubic centimeters. The wall was thickened; rugæ of mucosa very large; vascular supply abundant; mesosigmoid greatly thickened; neither pigmentation, so generally observed, nor ulceration of the mucosa were present. (No proper conception of the size or capacity of the dilated colon can be formed from the laboratory measurements of the excised segment.)

Microscopical examination. Submucosa very loose and thick; vessels of submucosa very large; slight increase of round cells and polymorphonuclears in submucosa. Muscular wall very much thickened.

The term megacolon, from the etiological viewpoint, is generally applied to the presumably congenital and idiopathic dilatation and hypertrophy of the large bowel which bears Hirschsprung's (20) name. Finney (13) reminds us, however, that several reports of the condition had appeared in the literature prior to Hirschsprung's original contribution in 1887. The designation, then, of "Hirschsprung's disease," appears to be a tribute to careful observation and description.

Hirschsprung believed, since the constipation began at birth, that the "evil lying at the root, must be considered either as an anomaly of development, or a pathological fœtal process." Mya (37), however, considered the dilatation congenital, but the hypertrophy secondary. Treves (52) thought that all cases were due to obstruction. Hawkins (17) was of the opinion that a neuromuscular defect was responsible for megacolon, an opinion concurred in by Mayo (34); and Perthes (41) viewed valve formation as the important etiological factor. Kauffman (28) divides congenital megacolon into two groups, one conforming to the theory of Hirschsprung, the other comprising instances of unusual length of the sigmoid colon, with the formation of loops and valve-like closures, or pressure by one loop upon another. Marfan (32) contends that the malady is due to the unusual length of the sigmoid, with the formation of kinks and the "valve lock."

The existence of an abnormally long mesentery, connective tissue hyperplasia of the rectum, chronic colitis, spastic contraction of the sphincter, and increased length of the sigmoid are additional theories of etiology, gathered from the literature by Finney, who states that no single factor accounts for all the cases. Finney believes that lymphangiectasis is of great etiological importance. Aschoff (2) more recently wrote: "Enlargements of the intestinal canal usually appear above stenoses; commonly, the dilatation, if its onset is not too acute, is accompanied by a work-hypertrophy of the musculature. These dilatations may attain an enormous size, especially in stenoses whose onset has been gradual or involving a valve. To the last group probably also belongs Hirschsprung's disease, the megacolon (Heller, Konjetzny, Perthes, Schmidt).

"According to most observers, it here conducts itself as a valvular shutting at the juncture of the abnormally long sigmoid flexure in the rectum. It is a congenital anomaly, which gives rise to a high-grade dilatation and hypertrophy of the whole

Fig. 1. The unusual position of the stomach is explained by Figure 2.

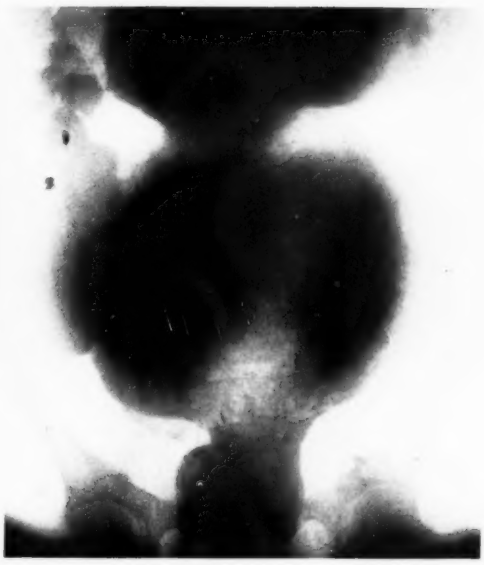


Fig. 2. The giant sigmoid in comparison with the normal ascending colon.

colon, by which the belly of the child is powerfully distended and its nourishment finally seriously endangered."

This description of megacolon is quite generally accepted, though in many of the reported cases, the sigmoid alone is involved.

Somewhat analogous to the "valvular shutting" of Aschoff, is the "angulation at the sigmoid" described by Delatour (11). Cantlie, according to Delatour, ascribes to the constriction at either end of the sigmoid, a definite sphincteric action. Delatour conceives spasm here with resultant slowing of the fæcal current, and a bending or sharp angulation of the heavy, redundant sigmoid at the rectosigmoid junction. Intestinal stasis is thus perpetuated and a definite syndrome established. The condition is demonstrated by roentgenography and the symptoms are relieved by resection of the sigmoid. Angulation, then, links the symptomless, functioning redundant sigmoid with the true megacolon. It is significant that Delatour notes the occurrence of the angulated redundant sigmoid in childhood, with the statement that the child had always been constipated.

Meyers (35) pertinently inquires what degree of hypertrophy and dilatation constitutes the so-called Hirschsprung's disease. The roentgenograms of all cases of persistent constipation show that many of the sigmoids are looped, twisted, redundant, dilated and hypertrophied, and the past histories of these cases are practically identical. Wagner (53) observes that the anatomical arrangement of the fixed rectum and the mobile sigmoid invites kinking.

Wilkie (57) cites the case of a man 60 years old, who had always been constipated. At operation the pelvic colon only was involved and there was evident kinking at the rectosigmoid junction. Wilkie believes that "an exaggeration of the long sling-like pelvic colon, found normally in the infants, is the cause of the disease." There is no evidence that hypertrophy is found at birth, as contended by Hirschsprung and Kredel, but a kink or valve forms by sagging, with subsequent dilatation and hypertrophy (Perthes).

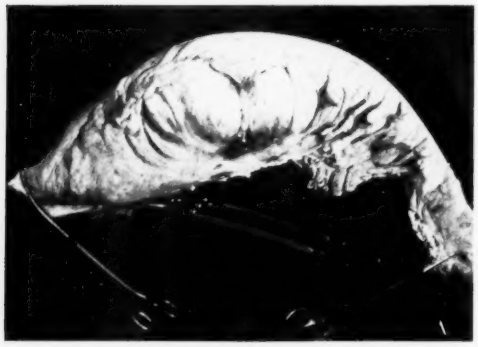


Fig. 3. The excised segment, contrasting the hypertrophied and the normal parts of the bowel.

Bensaude and Sorrel (5) state that an abnormally long loop of bowel is frequently abnormally large in every direction. The sigmoid flexure is almost invariably involved in megacolon. Bensaude and Sorrel found a kind of valve at the upper end of the rectum formed by simple kinking of the bowel.

Hoffman (21) believed that volvulus and chronic kinking of the lengthened and dilated sigmoid loop were the causes of Hirschsprung's disease in ten instances.

Bailey (3) concludes that megacolon may be due to any congenital defect that produces stasis, either through mechanical or neuropathic interference with peristalsis.

Although Walker (54) defines megacolon as a condition in which no definite obstructive lesion is found at operation or necropsy, we contend, in view of the reported discovery of kinks and valve formations at the rectosigmoid junction, that the likelihood of the unrecognized existence of such obstructions should be admitted.

Marchand (33), in 1903, held the opinion that an early obstruction might result in dilatation, and although the obstructive action soon ceases, a secondary hypertrophy, nevertheless, supervenes.

Daniel (10) reported the case of an infant whose imperforate anus was opened on the second day. Several years later Daniel operated for the relief of apparent megacolon. The susceptibility of the infantile colon to obstruction seems obvious.

Fenwick (12) notes that the appearance of the bowel in megacolon is exactly like that found above demonstrable obstructions, hence the process is not a congenital pathological entity, a view shared by Terry.

Granting the probability of a valve-like sigmoid obstruction, there must, in some instances at least, be another factor at work, since Ladd (29), Johnson (26), Stiles (48) and others have discovered enormous dilatation of the rectum also, at operation. Goebel (14) notes, in this connection, that surgeons are unable to demonstrate the cause of the dilatation which extends sometimes down to the anal ring. Goebel suggests that anal spasms might be severe enough to induce a reflex irritation leading to lesions analogous to those of megacolon. The local spasms of the sphincter might at least be considered a contributing cause to the colonic condition. Treatment, therefore, should aim to remove the tendency to spasm. The etiological importance of spasm was strikingly apparent to Popper (43), who was called to see twins 4 days old. One twin had died shortly before Popper arrived. The other appeared moribund with symptoms of shock, and an enormously distended abdomen. No meconium or flatus had been passed since birth, in spite of repeated enemata. A glass tube forced with some difficulty through the sphincter entered the roomy rectum. Pressure upon the abdomen forced meconium and flatus out of the anus and immediate relief of symptoms and reduction of the distention ensued. Since the dead twin had presented identical symptoms, Popper believed that both babies suffered from congenital megacolon. The diagnosis, in the case of the living twin, was subsequently confirmed by roentgenography.

Meyers reports six cases of dilatation of the colon in children from 4 to 9 years of age. The X-ray examination revealed sigmoid redundancy in each instance, plus megacolon in one. The obstinate constipation was entirely relieved in five instances, including the case of megacolon, by the administration of atropin, since the bowels functioned normally after discontinuing medication.

Fenwick observed spasms of the anal sphincter in a child in whom the dilatation and hyper-

trophy extended right down to the anus, and Holt (23) believes that the primary condition in megacolon is one of congenital hypertrophy, and that spasm is added to this.

Regarding the frequency of megacolon, Ladd, in January, 1921, collected from the literature 113 cases to which he added five of his own, making a total of 118. Ladd concludes, therefore, that the disease is uncommon. Hoffman (22), on the other hand, reviews 18 cases from Payr's service, which were operated upon during the 10 years preceding March, 1921, and believes that the condition is less rare than is generally assumed. Smith (47) gathered 392 reports to October 1, 1915. The discrepancy between the figures of Smith and those of Ladd may be accounted for by the fact that the latter considers the majority of the adult cases doubtful, since the history usually does not date back to infancy, or demonstrable mechanical obstruction exists. We believe that most cases of megacolon are probably reported, since the striking objective signs, the remarkable X-ray findings, the discovery at operation of a sigmoid limited in size, perhaps, merely by the confines of the abdomen and the subsequent surgical triumph or defeat, present a picture which invites description. It appears, therefore, that the publication of approximately five hundred reports during the greater part of a century, would indicate the infrequency of megacolon, particularly in view of the fact that many of the reports are based on a false premise (imperforate anus, for example), or lack roentgenographic, operative or postmortem confirmation.

A consideration of the age at which megacolon occurs, leads to the report by von Ammon (1), in 1842, of a case affecting a fœtus at the seventh month. Potter (44) states, however, that von Ammon's observation is incomplete. Finney cites several instances in which the abdominal distention of megacolon complicated delivery. Popper discovered the condition in twins 4 days old, and Ladd considers megacolon essentially a disease of childhood, an assumption based, naturally, upon the fact that Ladd's five cases came to operation at the ages of 2 months, and 3, 6, 7, and 9 years respectively.

Dilatations of the colon beginning in adult life, from whatsoever cause, have been termed "pseudomegacolon" by Hirschsprung. Johnson, however, considers such classification superfluous, if the term "megacolon" applies only when there is no demonstrable etiological factor. Popper believes that megacolon is exceedingly rare, if not unknown, in the adult, and Ladd states that it is occasionally possible for a patient to reach adult life with this condition, but that most of the cases reported in the adult do not give a continuous history from infancy.

The reports by Terry (50, 2 cases), Wilkie, Hubbard (24), Hawkins, Graves (16), Jackson (25), Herringham (18), and Johnson, of true megacolon in the adult, are well authenticated since the symptoms, in each instance, dated from birth or early infancy, and the diagnosis was confirmed at operation or autopsy. One patient, a man, was operated upon at the age of 78 years by Herringham. Hoffman, however, in reviewing 18 cases of megacolon, 16 of which affected adults, states that the picture of the disease may not develop until later in life. The relative frequency with which megacolon occurs in childhood and in maturity is suggested by the statement of Patel (40) that of 223 cases which came to operation or necropsy, only 73 were in adults.

The preconceived notion held by one of us (Fowler), that gigantism usually involved the entire colon, was proved erroneous by a survey of the literature. Among Ladd's cases, for example, there was only one instance in which the entire colon was involved; in three others, the descending colon and the sigmoid were affected, and in the fifth, the rectum, sigmoid, and descending colon were involved. Puls' (45) analysis of 104 cases revealed the sigmoid alone involved in 35 per cent, the entire colon in 27 per cent and the sigmoid either alone or with other segments in 84 per cent. Mummery (36) noted that the sigmoid was chiefly affected in 80 per cent of the cases. In Hirschsprung's two original cases, the sigmoid was chiefly involved. Neugebauer (38) stated that the sigmoid alone was the site of the disease in 74 out of 169 cases, and Barrington-Ward (4) found all sigmoids dilated in 19 autopsies on children. Brewer (7), in

writing of megacolon, states that there is chronic dilatation of the sigmoid and even of the greater part of the descending and transverse portions of the colon. Blake (6) found the upper rectum and sigmoid enormous in a woman 24 years old, and the mesosigmoid was so long that the sigmoid loop could be lifted 15 inches outside of the abdomen. Finney observed that in more than one-third of the cases, the sigmoid alone was involved, and in practically all instances it was included; and Judd (27) believes that in practically all cases, the large bowel is involved and especially the sigmoid.

Regarding the relative frequency with which megacolon affects the sexes, Mummery records a prevalence in males, in the proportion of 3 to 1.

Although a familial tendency is exceedingly rare, Popper reports the occurrence of megacolon in newborn twins. More striking, perhaps, is the observation by Graves of an instance of this malady in a woman 21 years old, whose sister had died in infancy without a normal evacuation. Welt-Kakels (56) reported a similar case of colonic dilatation in an adolescent boy whose brother had died at the age of 8 years, without having had a normal movement. Machell (31) presents a well-authenticated example of the familial tendency in his report concerning two brothers. Operation upon the elder, at the age of 3 years, revealed dilatation of the entire colon and the rectum. Necropsy on younger on fifteenth day disclosed dilatation of the entire colon with some thickening of the bowel wall. Finney cites three instances of familial megacolon.

The symptomatology of megacolon, according to Popper, consists of obstinate constipation, marked distention and active, visible peristalsis, finally accompanied by signs of intestinal toxæmia, and usually resulting in early death. This active, acute process begins at birth or soon after, and the dilatation and hypertrophy are present from the start. Popper believes that a milder type, beginning in early childhood and characterized by abdominal enlargement and severe constipation, is probably acquired. Most observers, however, consider the latter type true megacolon pursuing a chronic course.

Stiles has observed children a few months old in whom constipation has been obstinate since birth and the mothers state that the constipation gets gradually worse and worse and the abdomen gets bigger and bigger. The bowel movements, at intervals of 2 or 3 weeks, are loose and accompanied by colicky pains. Such diarrhœa is usually of short duration and is well tolerated, but the terminal type observed by Hirschsprung is profuse and continuous with increasing prostration, until death.

Although vomiting is unusual, Ladd notes that when the toxæmia markedly increases, periods of vomiting and accentuated distention occur and dyspnœa and cardiac embarrassment may ensue. Such attacks demand prompt relief. The typical picture, according to Ladd, is that presented by an emaciated child with a prominent abdomen; the veins of the abdominal wall are conspicuous; the dilated coils of the colon are apparent and masses can be felt within them. The skin, except over the abdomen, is loose and dry, the complexion sallow and the facial expression dull. Enemata and catharsis are followed by copious, offensive stools. The X-ray picture succeeding a barium enema confirms the diagnosis.

Although Peskind (42) observes that the worst feature of megacolon consists of progressive nutritional disturbances, the disease, nevertheless, frequently pursues a decidedly chronic course. Indeed, Finney, in accord with general opinion, considers the malady to be essentially chronic. There is often, as noted by Stiles, Johnson, and others, a remarkable lack of subjective symptoms, with good appetite, apparent good health, and even gain in weight provided the bowel is kept relatively empty.

The reaction to constipation varies. Hirschsprung treated an infant 7 months old, who had had but one insignificant movement in 2 weeks, yet the baby seemed free from ailment. Linde (30), on the other hand, noted signs of toxæmia or convulsions in his three-and-a-half-years-old patient, if 5 days were allowed to pass without an evacuation. Generally the immunity from toxæmia in the youthful sufferers from megacolon is surprising.

Adults, however, develop even more striking immunity since stool-free periods of weeks or even 3 to 4 months, induce only moderate auto-intoxication; mental torpor, however, is constant during fæcal retention.

Instances of acute obstruction of the redundant sigmoid, usually volvulus, have been reported. In the case described by Critchlow (9) of a man 42 years old, there had been several previous obstructive attacks. At operation Critchlow observed that the enormously dilated sigmoid loop had been forced by its gaseous content to the lateral and upper confines of the abdomen and the base of the loop was twisted. The affected bowel, unlike the uncomplicated megacolon, did not present in the incision. (This volvulus and the consequent remarkable distention of the sigmoid loop is beautifully illustrated in Hirschman's (19) book.) Nuzum (39) reports the occurrence of acute obstruction of another type in a child 6 years old, who had always been obstinately constipated. At operation for the relief of acute symptoms, megacolon and an obstruction due to kinking of the sigmoid in the pelvis were observed. The enormous accumulation of fæces in the descending and pelvic colon of a 10-year-old sufferer from megacolon was the unusual cause of acute obstruction in a case reported by Tewfik (51).

Hypertrophy is usually but not invariably present, since Cadwallader (8) and Hawkins, for example, each report a case of undoubted megacolon in which dilatation without hypertrophy was manifest. In both instances the bowel was markedly dilated and thinned by gaseous distention. In this connection Wilkie states that, in the adult, dilatation can only follow the failure of the compensatory hypertrophy. We believe, however, that the free or slightly obstructed redundant sigmoid may remain for years unchanged in its caliber, and in the thickness of its walls, but a suddenly increased obstruction at any time would be followed by dilatation of the bowel and a thinning of the wall.

The diagnosis of megacolon in childhood, according to Ladd, should be relatively simple since the conditions which simulate it, chronic indigestion with constipation, rickets, tubercular peritonitis and acute obstruction present, each, a different picture in its entirety. The recognition of the malady in adults, also, Finney observes, is ordinarily not difficult since it is to be differentiated from tubercular peritonitis, some forms of chronic ileus, annular carcinoma of the intestine, dysenteric ulceration, ovarian cysts, etc.

Of importance, too, in the differential diagnosis is the observation made by Finney that ascites does not accompany megacolon. Although abdominal distention and obstinate constipation with freedom from objective symptoms are pathognomonic of the disease, we are reminded by Peskind that there may be quite regular evacuations, even eight or ten daily, without appreciably decreasing the fæcal retention, a seeming paradox explained, Ladd says, by the fact that the liquid fæces finds its way around the solid masses without dislodging them.

The treatment of megacolon seems essentially surgical yet Ladd discovered to his surprise, that the surgeons suggested medical treatment and the clinicians advised operation. Dietary regulation and improvement of hygiene with measures designed first to empty the bowel and second to establish normal peristalsis, are the requisites of medical treatment. Meyers observed, in one case, a predominance of starches in the diet. A rational dietary and the administration of atropin resulted in apparent cure. Griffith and Crozer (15) believe that operation is indicated only when the health begins to suffer, and Ladd is of the opinion that non-operative measures should be tried in the borderline cases before resorting to surgery. Peskind considers the treatment chiefly medical, operation being indicated only when the condition does not yield to rectal lavage or when obviously necessary in late cases to save life. Johnson, on the other hand, states that little is to be expected from medical treatment and one of us (Fowler) holds that the difficulty, if not impossibility, of bringing away the fæcoliths, is the chief bar to medical treatment. It is evident, also, in the pronounced case, that the widely dilated sigmoid which has become, in fact, a reservoir, could not reasonably be expected to empty

itself. Indeed, roentgenograms after medical treatment usually demonstrate that the size of the colon remains unchanged, although Meyers reported one instance in which the bowel did appear to be smaller following the administration of atropin in a case of moderate severity. The delay incident to a test of medical treatment would ordinarily be harmless, even though such treatment proved ineffectual, since the systemic disturbances of megacolon are transitory and disappear with the relief of the stasis. In the advanced case, however, medical treatment at best accomplishes merely partial removal of the retained fæces at intervals. Between times, the patient is mentally sluggish with consequent decreased earning capacity, if an adult, and lessened enjoyment of life. The dictum of Ladd, that operation should be unhesitatingly advised in such instances, should, therefore, be generally accepted.

Surgical treatment aims, of course, at removal of the functionless bowel and restoration of the intestinal continuity. The procedures vary according to the preference and judgment of the individual surgeon. For example, Johnson favors the single stage operation, whereas Finney advocates a preliminary colostomy with secondary resection and anastomosis. Johnson reminds us, however, of the liability to fæcal contamination during operation due to the difficulty of pre-operative drainage of the liquid fæces from the colonic reservoir. Ladd, also, recognizes the danger of contamination, since the ordinary types of intestinal holding clamps fail to occlude the hypertrophied bowel. Only the heavy crushing clamps of Payr are effectual. In the event of leakage, the anastomosis must, of course, be deferred. Johnson performs an end-to-end anastomosis with partial closure of the dilated lower segment, but Ladd prefers an end-to-side union. Ladd emphasizes, also, the importance of passing a rectal tube through the anus and up beyond the anastomosis. Resection and anastomosis in one stage, provided the patient's condition and faultless technique permit, is ideal. When good judgment dictates a less radical course, however, the stage or stages beyond the first will be complicated by adhesions. There can be no rule of procedure, since each case presents its individual problems. According to Wells (55), in writing of rectal carcinoma, "a colostomy is not the dreadful thing we used to think it was." Patients have warning when the bowels are about to move, and there is no soiling. In the treatment of megacolon, however, we contend that a permanent colostomy is seldom justified. If the patient is willing to assume the risk incident to the re-establishment of the intestinal continuity, the surgeon certainly should be. Patel reminds us that the surgical mortality in infancy is high, since under the age of 2 years, thirteen deaths followed thirteen operations, and after laparotomies between the ages of 2 and 5 years, only four of fourteen patients survived. Surgical treatment is not uniformly successful, since Hawker, Richardson (46) and Stiles each report a case in which dilatation recurred following operation.

A statistical comparison made by Ladd of the results of medical and surgical treatment in megacolon, is interesting. Sixty cases were treated medically with 41 deaths, a mortality of 67 per cent; 7 were cured, 12 per cent; 58 cases received surgical treatment with 24 deaths, a mortality of 41 per cent; 24 were cured, 41 per cent. Patel states that about 57 per cent of the 74 children, and 57 per cent of the 41 adults who were subjected to operation were cured. Ladd notes that the surgical deaths resulted from peritonitis, due to technical errors, rather than from intolerance of the operative procedures, *per se*. Neugebauer reported that medical treatment proved curative in only 1.5 per cent of 133 cases.

The prognosis of megacolon, according to Finney, is largely that of intercurrent diseases consequent to malnutrition. The patient leads a precarious existence with the greatest likelihood of a fatal termination in infancy. Stone (49) states that the deaths in early childhood are due to obstruction, volvulus, perforation, toxæmia, or exhaustion. Herringham, however, reports a death from perforation in a man 78 years old.

The admirably comprehensive survey of megacolon published by Finney in 1908

leaves little to be added. Nevertheless, the theories regarding the etiology are as numerous as ever. We thus find justification for this report and for a reassembling of the facts and fancies concerning megacolon together with an expression of our own views.

SUMMARY

There is scant clinical verification of the theory that megacolon is a congenital pathological entity. The normal tendency toward sigmoid redundancy in the newborn has been noted. The sigmoid is always involved in megacolon, and redundancy has been observed with striking frequency. The anatomical arrangement—fixed rectum and mobile sigmoid—invites functional obstruction at the rectosigmoid junction, and kinks and valve formations have been clinically demonstrated here. When such obstructions are not demonstrable, we may assume that they existed previously, since the dilatation and the hypertrophy encountered in the so-called idiopathic megacolon cannot be differentiated from those which follow organic obstructions.

CONCLUSIONS

1. The so-called idiopathic megacolon is relatively infrequent in childhood and rare in the adult.

2. The only congenital feature of megacolon is the redundant sigmoid.

3. The unobstructed redundant sigmoid may be nearly or quite symptomless.

4. The degree of obstruction, from whatsoever cause, determines the subsequent course.

a. Relatively slight obstruction (the "angulation" of Delatour) produces a definite syndrome without dilatation or hypertrophy.

b. Acute obstruction (usually volvulus), either primary or superimposed upon hypertrophy, induces sudden dilatation and the desperate picture common to such obstructions.

c. Chronic obstruction causes gradual dilatation and compensatory hypertrophy, the type described by Hirschsprung.

5. Kinking, or valve-like action at the rectosigmoid junction, is the usual cause of obstruction. When the rectum, also, is involved, anal spasm is a likely factor.

6. The surgical treatment of megacolon aims at removal of the crippled bowel and restoration of the intestinal continuity.

We express appreciation to Miss Adelaide C. Bowen, of the laboratory staff of the Highland Hospital, for the translations from the German, and to Mr. Charles P. Silliman, the X-ray technician, for his excellent photographs.

REFERENCES

A complete bibliography to January 1, 1908, is appended to Finney's paper in SURGERY, GYNECOLOGY AND OBSTETRICS for June, 1908, and Cadwallader in *Archives of Pediatrics*, 1916, xxxiii, 665, has continued the bibliography to January 1, 1916.

1. AMMON, VON. Quoted by Finney and Potter.
2. ASCHOFF. Pathologische Anatomie, 5th ed., vol. ii, p. 846.
3. BAILEY. Congenitomechanical dilatation of the colon. J. Missouri St. M. Ass., 1914, Aug.
4. BARRINGTON-WARD. Quoted by Hubbard.
5. BENSAUDE and SORREL. Abstracted J. Am. M. Ass., 1914, March 28, 1054.
6. BLAKE, J. A. Megacolon. Ann. Surg., 1912, March, 455.
7. BREWER. Quoted by Hubbard.
8. CADWALLADER. A case of Hirschsprung's disease. Arch. Ped., 1916, xxxiii, 665.
9. CRITCHLOW. Abstracted J. Am. M. Ass., 1911, Nov. 25, 1788.
10. DANIEL, PETER. Internat. Clin., 19th series, vol. iii, 196.
11. DELATOUR, H. B. Angulation at the sigmoid. Surg., Gynec. & Obst., 1918, xxvi, 285.
12. FENWICK, W. S. Hypertrophy and dilatation of the colon in infancy. Brit. M. J., 1900, Sept. 1.
13. FINNEY, J. M. T. Congenital idiopathic dilatation of the colon. Surg., Gynec. & Obstet., 1908, vi, 624.
14. GOEBEL. Abstracted J. M. Am. Ass., 1921, March 12.
15. GRIFFITH, J. P., and CROZER. Arch. Ped., 1918, Jan.
16. GRAVES, STUART. Congenital idiopathic dilatation of the colon. Ann. Surg., 1918, p. 734.
17. HAWKINS, H. P. Idiopathic dilatation of the colon. Brit. M. J., 1907, March.
18. HERRINGHAM, W. P., and CLARK, B. Idiopathic dilatation of the sigmoid flexure. Brit. M. J., 1894, Dec. 1.
19. HIRSCHMAN. Handbook of Diseases of the Rectum. 3d ed., p. 78.
20. HIRSCHSPRUNG. Bowel sluggishness in the newborn, the result of dilatation and hypertrophy of the colon. Jahrb. f. Kinderh. u. physische Erziehung., 1887, xxvii, 1.
21. HOFFMAN. Abstracted Am. Inst. M., 1921, June.
22. HOFFMAN. Abstracted J. Am. M. Ass., 1921, May 21, 1436.
23. HOLT. Quoted by Meyers.
24. HUBBARD, J. C. Megacolon. Ann. Surg., lxiii, 349.
25. JACKSON, W. R. Megacolon, megasigmoid. Ann. Surg., lxvi, 441.
26. JOHNSON. Megacolon in the adult. Boston M. & S. J., 1921, Feb. 21.
27. JUDD, E. S. Megacolon. Collected Papers, Mayo Clinic, 1905-09.
28. KAUFFMAN. Lehrbuch der speziellen pathologischen Anatomie. 1909, p. 444.
29. LADD. Megacolon. Boston M. & S. J., 1921, Feb. 21.

30. LINDE, J. I., and KLEINER, S. B. A case of congenital, idiopathic dilatation of the colon. Arch. Ped., 1915, xxxii, 278.
31. MACHELL, H. T. Canad. J. M. & S., 1913, July.
32. MARFAN. Quoted by Petrivalsky, J. Zur Hirschsprung'schen Krankheit. Arch. f. klin. Chir., 1908, lxxxvi, 318.
33. MARCHAND. Quoted by Finney.
34. MAYO, W. J. A study of the rectosigmoid. Surg., Gynec. & Obst., 1917, xxv, 616.
35. MEYERS, A. E. Dilatation of the colon in children. Am. J. Diseases Child., 1920, March.
36. MUMMERY. Quoted by McKerrow. Brit. M. J., 1913, ii, 811.
37. MYA. Quoted by Graves.
38. NEUGEBAUER. Quoted by Hubbard.
39. NUZUM. Abstracted Am. Inst. M., 1921, June.
40. PATEL, M. Abstracted J. Am. M. Ass., 1910, Dec. 3, 2019.
41. PERTHES. Quoted by Wilkie.
42. PESKIND, A. Megacolon in childhood. Med. Record, 1917, June 23, 1089.
43. POPPER, J. Congenital megacolon. New York M. J., 1920, Dec. 25, 205.
44. POTTER, P. S. Internat. Clin., 19th series, vol. iii, 196.
45. PULS. Quoted by Terry.
46. RICHARDSON. Abstracted Year Book of Surg., 1902, p. 132.
47. SMITH. Quoted by Graves.
48. STILES. Discussion of Terry's paper.
49. STONE, E. H. Idiopathic dilatation of the colon. Boston M. & S. J., 1908, March 26.
50. TERRY, W. I. The surgical treatment of megacolon. J. Am. M. Ass., 1911, Aug. 26.
51. TEWFIK, I. A case of Hirschsprung's disease, causing acute obstruction. Lancet, Lond., 1921, Feb. 21.
52. TREVES, FREDERICK. Abstracted Year Book of Surgery, 1899, p. 313.
53. WAGNER. Surg., Gynec. & Obstet., 1908, Jan.
54. WALKER. Lancet-Clinic, 1910, Feb. 19.
55. WELLS, E. A. Observations on cancer of rectum. Surg., Gynec. & Obstet., 1920, xxxi, 472.
56. WELT-KAKELS. Quoted by Graves.
57. WILKIE, D. P. D. Hirschsprung's disease. Edinburgh M. J., 1909, iii, 203.

BIBLIOGRAPHY

From January 1, 1916, to January 1, 1921, exclusive of the references in this paper.

DEL VALLE. Rev. Asoc. med. argent., Buenos Aires, 1915, xxiii, 959-977.
DIEDOFF. Kharkov. M. J., 1916, xx, 241-256.
ELIZALDE. Rev. Asoc. med. argent., Buenos Aires, 1915.
JONNES. Lancet-Clin., 1916, cxvi, 204-208.
JONG, DE. Nederl. Tijdschr. v. Geneesk., Amst., 1916, i, 1788-1801.
SMITH. Lancet-Clin., 1916, cxv, 269-273.
ALEXANDER. Surg., Gynec., & Obst., 1917, xxiv, 484-486.
ARANA. Semana med., Buenos Aires, 1917, xxiv, 671-709.
BAIRD. South M. J., 1917, x, 846-848.
BRUIN, DE. Nederl. Tijdschr. v. Geneesk., Amst., 1917, i, 1846.
CAMERON. Guy's Hosp. Gaz., Lond., 1917, xxxi, 277.
ERNBERG. Hygiea, Stockholm, 1916, lxxviii, 515-517.
GRIFFITH. Am. J. Obst., 1917, lxxvi, 524.
HAMANN. Cleveland M. J., 1917, xvi, 88-93.
JOHNSON. U. S. Nav. M. Bull., 1917, xi, 223.
KENNEDY. Grace Hosp. Bull., Detroit, 1916-17, i. No. 4, 11-14.
KOCHER. Cor.-Bl. f. schweiz. Aerzte, 1917, xlvii, 60.
MEHLISS. Deutsche Ztschr. f. Chir., 1916, cxxxv, 475-495.
QUÉNU. Bull. et mém. Soc. méd. d. hôp. de Par., 1916, 3. S., xl, 2389-2396.
STRATER. Nederl. Tijdschr. v. Geneesk., Amst., 1917, i, 2180.
VINAS. Prensa med. Argentina, Buenos Aires, 1916-17, iii, 172.
ARONSON. New York M. J., 1918, cviii, 196-198.
CARR. Arch. Pediat., 1918, xxv, 352-354; New York M. J., 1918, cviii, 615.
CUMSTON. Brit. J. Child. Dis., Lond., 1918, xv, 21-26.
GULEKE. Deutsche med. Wchnschr., 1917, xliii, 1607.
KONIG. Muenchen. med. Wchnschr., 1917, lxiv, 1276.
LE WALD. Am. Atlas Stereoroentgenol., 1917, ii, 186-190.
LUZZATO. Med. nuova, Roma, 1917, xiii, 221-223.
MICHAUX. Virginia M. Monthly, Richmond, 1918-19, xlv, 144-145.
NOBLE. Am. J. Obst., N. Y., 1917, lxxxvi, 946, 949; Tr. Am. Ass. Obst. & Gynec., 1917-18, xxx, 125-128.
REICHE. Med. Klin., Berl., 1918, xiv, 712.
TRONNES. J.-Lancet, 1918, xxxviii, 625-628.
BAUERMEISTER. Zentralbl. f. Roentgenstrahl., 1918, ix, 5.
BRADENSTEIN. Berl. klin. Wchnschr., 1919, lvi, 347.
CARR. Tr. Am. Pediat. Soc., Chicago, 1918, xxx, 108-113; Pennsylvania M. J., 1918-19, xxii, 705-12.
DEL VALLE. Pediatria, Napoli, 1919, xxvii, 515-526.
GALLO. Semana med., Buenos Aires, 1919, xxvi, 318-323.
GUYOT. Gaz. hebd. d. sc. méd. de Bordeaux, 1919, xl, 123-125
GRIFFITH. Med. Clin. North America, 1918, ii, 829-840.
LACHMANN. Muenchen. med. Wchnschr., 1918, lxv, 1244-1246.
PAUCHET. Bull. et mém. Soc. de chir. de Par., 1919, xlv, 1198-1215.
QUISUMBING. Rev. Filipina de med. y farm. Manila, 1918, ix, 259-263.
SOHMER. Minnesota Med., St. Paul, 1918, i, 119-125.
TALMA. Nederl. Tijdschr. v. Geneesk., Amst., 1919, i, 1848-1858.
TAUBENSCHLAG. Semana med., Buenos Aires, 1919, xxvi, 229-244.
TEWFIK, I. Lancet, Lond., 1920, i, 436.
MINKOWSKI. Berl. klin. Wchnschr., 1919, lvi, 956.
GUYOT. Bull. et mém. Soc. de méd. et chir. de Bordeaux, 1919, 23-27.
BLANCO, V. Semana med., Buenos Aires, 1920, xxviii, 740-752.
DELBET, P. Bull. et mém. Soc. de chir. de Par., 1920, xlvi, 893.
GOEBEL, T. Arch. f. Kinderh., Stuttg., 1920, lxviii, 221-24; Kor.-Bl. d. allg. arztl. Ver. v. Thuringen, 1920, xlix, 26.
GULEKE. Ibid., 74.
KACKELL, R. Berl. klin. Wchnschr., 1920, lvii, 1021.
MICHON and OKNICZYC. Bull. et mém. Soc. de chir. de Par., 1920, xlvi, 609-611.
CARNOT, P., and TRIEDEL, G. Arch. d. mal. de l'appar. digest. (etc.), Par., 1919-20, x, 577-590.
CHIOSSONE, F. Rev. med.-quir., Tegucigalpa, Honduras, 1919-20, i, No. 5, 9-12.
COMBY, J. Arch. de med. d. enf. Par., 1920, xxiii, 493-497.
CONSTANTINE, P. Gazz. d. osp., Milano, 1920, xli, 868-871.

NOTE.—The excellent paper by Dowd entitled "The Surgical Treatment of Megacolon," appeared in *Annals of Surgery* for October, 1921, after this paper had been accepted for publication.

PATHOLOGICAL FRACTURES[1]

By E. A. CODMAN, M.D., F.A.C.S., Boston

SINCE I have had little personal experience in the treatment of pathological fractures, my function has been to review the literature of this subject in order to give you in 10 minutes a résumé of present recorded knowledge concerning it. I will give a minute to each of ten headings.

1. The literature. Go to Eisendrath in Keene's *Surgery*. He will give you an excellent survey and quote largely from Grunert who reviewed the literature up to 1904 most thoroughly. If you want more references, the Registry of Bone Sarcoma has collected many for your service, but the articles contain little new except Bloodgood's dictum; "fracture as the symptom of onset in a central lesion suggests a bone cyst, and if the patient is 15 years of age or younger, it may be looked upon as almost pathognomic." This is likely to prove a diagnostic rule of permanent value.

2. Etiology. As secondary causes almost every human activity is mentioned; walking, running, coughing, sneezing, getting up or sitting down, and even turning over in bed. A pathological fracture implies a trivial cause acting on abnormal bone. I see no profit in listing these secondary causes, as they are not important in diagnosis, prognosis, or treatment, but we must in every case consider the possible pathological possibilities and not jump to the diagnosis of sarcoma too quickly. Eisendrath's table shows a list of possible causes.

EISENDRATH'S TABLE OF CAUSES OF PATHOLOGICAL FRACTURE[2]

1. Fractures resulting from bone fragility of local origin
   - A. Through tumors
     - a. Primary and metastatic sarcoma
     - b. Metastatic carcinoma
     - c. Adenocarcinoma from the thyroid (osseous metastases)
     - d. Enchondroma and benign osseous cysts
     - e. Metastatic hypernephroma
     - f. Echinoccoccus cysts
   - B. Inflammatory processes
     - a. Pyogenic osteomyelitis
     - b. Tuberculous osteomyelitis
   - C. Aneurisms
2. Fractures resulting from bone fragility due to some general disease
   - A. Neuropathies
     - a. Tabes dorsalis
     - b. Syringomyelia
     - c. Mental diseases (paresis)
   - B. Senile changes
   - C. Exhausting chronic diseases
   - D. Atrophy due to non-use
   - E. Scurvy
   - F. Rachitis and osteomalacia
3. Fractures resulting from idiopathic fragility of bone (osteoporosis, fragilitas ossium)

3. Pathology. These fractures differ from ordinary fractures in other respects than in the trivial cause. They are more apt to be bendings, bowings, bucklings, telescopings, and impactions. They are usually transverse, but may be oblique with one end of the fracture starting in the lesion. One such case in a true osteogenic sarcoma of the femur is recorded in the registry. As a rule the ends do not tend to separate widely or slip by one another. Yet they are not "greenstick" but rather "rotton wood" fractures. The ends have not life enough to spring into sharp fragments. These features probably account for the fact that such fractures are less painful than those in sound bones. This is particularly true in tabetic cases. I have not time to consider the pathology of the general lesions causing pathological fractures, for this symposium concerns sarcoma especially.

4. The pathology of bone tumors. Since pathologists cannot or will not give us a standard nomenclature of bone tumors, I will venture with a certain amount of levity a safe surgical one:

a. Osteitis fibrosa. This includes ordinary bone cysts and the hæmorrhagic osteomyelitis of Barrie and possibly my next heading.

b. Bloodgood's giant-cell tumor, called myeloma in Canada and in Europe. These are benign, but if they do not prove benign, they belong in my next heading.

c. Giant-cell sarcoma. I do not mean sarcoma with giant cells, but an epulis-like tumor with "foreign body giant-cells" and an histological appearance indistinguishable to a

[2] From Keen's Surgery, vol. ii, 83.

[1] Read before the Clinical Congress of American College of Surgeons, Philadelphia, October, 1921.

surgeon's eye from Bloodgood's giant-cell tumor, *but which eventually proves malignant.* The Registry of Bone Sarcoma is putting Bloodgood and Ewing on trial to see whether it is possible to discard this heading.

d. True osteogenic sarcoma whether central or periosteal, for they are usually more or less both. These are definitely malignant, and as a rule easy to recognize clinically, histologically, and roentgenologically.

e. Metastatic new-growths, cancer, hypernephroma, etc. A hopeless class.

f. Multiple myeloma with or without albuminosuria.

g. Tumors of tissues which normally occur in bone as well as in other parts of the body, such as nerves, vessels, and fat. These are fortunately rare for histologically they make great confusion by causing secondary bone destruction and proliferation.

h. Tumors too common and well understood to include, e.g. chondroma and osteoma and lesions of syphilis and tuberculosis.

i. Tumors too rare and little understood by even pathologists, for the surgeon to take them into practical consideration, e.g. the tumors of the specific marrow cells.

5. Differential diagnosis. A differential diagnosis is essential for proper treatment. Any of these tumors may be the cause of a pathological fracture. Such diagnosis is largely histological but there are many clinical and roentgenologic points which Bloodgood has ably set forth. To amputate the leg unnecessarily for a giant-cell tumor is almost worse than to procrastinate in a case of true sarcoma, for the results after early amputation in the latter are not very encouraging. Formerly I felt so hopeless in regard to amputation, that I was lukewarm about even exploratory incision. The registry has, however, found enough cured cases of the malignant type to convince me that amputation may be worth while, and I now feel that exploratory incision should be the rule, not only in cases of pathological fractures but in any bone tumor. My association with Dr. Ewing and Dr. Bloodgood has made me feel that in the majority of cases, with proper sections, clinical history, and X-rays, an expert pathologist can make a differential diagnosis. They will admit that a few borderline cases puzzle them. It is in such cases that radium seems most applicable, for it apparently benefits benign cases and retards malignant ones.

6. Prognosis. With the exception of those caused by new-growths it is a rule that pathological fractures tend to unite without much delay. Those due to carcinoma and other metastases rarely if ever do. Those due to osteitis fibrosa, cysts and giant-cell tumor, eventually unite, and a few cases due to sarcoma have been reported as uniting before death occurred. Two of these were metastatic sarcoma.

7. The treatment is the appropriate treatment of the lesion which has weakened the bone. Exploratory incision and expert pathological opinion are the first steps. It is not necessary to be very thorough in curetting the walls of cysts. Evacuating the contents, crumpling in the walls and realigning the bone is enough. If due to a giant-cell tumor, the wound should be opened widely and every bit of the current-jelly tissue removed. In malignant conditions, amputation will be wise even if metastases are already present, for these cases do not unite.

Without convincing histologic opinion, the experienced surgeon will not take off a limb when he finds a cystic cavity or red current-jelly tissue at the site of fracture; and he may amputate in spite of a negative report if he finds the soft tissues infiltrated with grayish, malignant-looking material. Where the fracture is the first or an early symptom, the assumption should be that the cause is benign.

In hopeless cases, where amputation has been refused, X-ray, radium, and Coley toxins may be tried, but the evidence collected thus far by the registry is not very favorable for any of these remedies in clearly malignant cases.

8. Prophylaxis. If we may judge by the material thus far accumulated by the registry, it should be a general rule to splint all cases of tumors of the long bones, as soon as they are observed. This applies particularly to tumors of the humerus and femur, which are not supported by a companion bone as are the ulna, radius, tibia, and fibula. Of 19 humerus cases, pathological fracture was

found in 47 per cent; of 102 femur cases in 15 per cent; of 79 cases of the four self-splinting bones in only 5 per cent. As a total it occurred in at least 14 per cent of the 200 supposed cases of sarcoma of the long bones so far reported to us.

I realize that this figure is inaccurate but I believe it is conservative, for in many of the cases included we have only a meager clinical history and no X-rays. The X-ray often reveals an unsuspected fracture. Then too, fractures will occur in more of the cases after they are reported to us, in their terminal stages. I say supposed sarcomata for we are finding on analysis that very often a sarcoma is not a sarcoma at all. But if 14 per cent of *supposed* sarcomata fracture from slight causes the rule applies to supposed sarcomata at least.

I know that Ewing has long felt that every sarcoma of a long bone should be splinted and kept in bed, on account of the danger of metastases. Yet I do not think that surgeons have made this a general rule, nor do I find it in the literature.

9. Theory. The subject we are discussing may be construed to include the question of whether fracture ever causes sarcoma. The literature contains many articles discussing this proposition, and great names may be found on both sides. Fracture in a healthy bone calls forth the repair process we know as callus. We know that callus may be exuberant and histologically resemble sarcoma, confusing our best microscopists. Suppose that the repair process starts and does not stop. Would this be malignancy? The definition of malignancy given by most pathologists is: "a new formation of cells which proliferate continuously and without control." Malignancy may be only an unbridled repair process and not the result of a stimulant emitted by bacteria, protozoa, or parasites. We have been looking for a positive cause. May not the cause be negative as by the removal of an inhibition? Without the fibrin ferment we bleed to death. Perhaps without the repair-checking ferment we repair to death?

10. Research. In closing a review like this, which is supposed to cover what we know of the subject, may it not be well to suggest what we want to know? At present these so-called giant-cell tumors particularly are occupying the attention of pathologists. May they not be due to rupture of nutrient vessels by fissure fractures? Suppose that the ruptured nutrient artery bleeds in the spongy bone as the temporal artery bleeds in some cases of fissure-fracture of the skull. A pulsating hæmatoma within the bone forms. This is followed by pulsating granulation tissue, which by pressure destroys the trabeculæ. Intraosseous "proud flesh" is formed and new bone cannot compete with its pressure. Will someone produce these tumors experimentally with fissure fractures or by trephining small holes and suturing large arteries in them? Cysts may be one stage of such lesions.

In closing let me remind you of the existence of the Registry of Bone Sarcoma and the need it has for the record of every case that comes to the knowledge of any member of this audience.

UNUSUALLY HIGH DEGREE OF LEUCOCYTOSIS FOLLOWING SPLENECTOMY FOR BANTI'S DISEASE

By JAMES E. THOMPSON, M.B., B.S.(Lond.), F.R.C.S.(Eng.), F.A.C.S., and V. H. KEILLER, M.D.,
Galveston, Texas
From the Department of Surgery, University of Texas

THE following report is submitted because of the unusual degree of leucocytosis following splenectomy for Banti's disease which persisted for at least two months after operation without evidence of infection. Prince in the *Journal of the American Medical Association*, 1915, reports a postoperative leucocytosis reaching 37,700 on the twenty-second day after the removal of the spleen for splenic anæmia, which subsided to 10,000 on the thirty-fourth day; and as second case in which the spleen showed a chronic splenitis plus a typhoid abscess with a white count of 25,800 on the third day and 14,000 on the fourteenth day. Both these cases were without evidence of postoperative infection. A moderate degree of leucocytosis, from 11,000 to 13,000 appears to be the rule. No counts comparable to those here recorded, have been met with in the course of our reading, and they occasioned considerable alarm. Except for the elevation of temperature recorded there was no indication of infection, and the long period of time during which the patient was under observation makes it reasonable to suppose that any infective condition sufficient to cause such a leucocytosis would have made itself manifest.

R. S., male, white, single, age 49, entered the John Sealy Hospital, February 24, 1920; dismissed July 23, 1920.

The father died at the age of 63, of Bright's disease. The mother is living and well, aged 83. Two brothers are living and well. There is no history of tuberculosis or cancer.

Patient had measles at the age of 6 months; no other diseases of childhood. At 25 years of age he had ulcers of the throat and spat blood; he was treated in various ways for 1 year, and was finally cured by cauterization of the ulcers. Eight years ago he had a severe cough, lost some weight, but had no hæmoptysis nor other indication of tuberculosis, and recovered completely in a few months. He had influenza in 1918; no complications. Two years ago all his teeth were removed for pyorrhœa. He denies venereal infection.

Patient came under the care of Dr. James E. Thompson, February 24, 1920, complaining of weakness and loss of appetite, and enlargement of the spleen. His illness began about 3 years ago; he became pale, lost his appetite and had occasional attacks of vomiting. A few months after the onset of his symptoms, he consulted a physician who found enlargement of the spleen. When his attention was called to it, the patient found that he could detect the tumor himself. Since that time he has used numerous "tonics" but the loss of strength and weight have been progressive, and the tumor has steadily increased in size. Lately there have been no vomiting attacks; there has never been hæmatemesis.

Physical examination. Patient had been well developed physically but showed extreme emaciation and muscular weakness. The skin over the whole body had a brownish discloration, much like sun tan; across the upper part of the abdomen and the chest there were a few areas which were free from pigment and these contrasted strongly with the dark color of the remainder of the skin. There was no eruption nor roughness in the discolored areas. There was no jaundice either in the skin or conjuctivæ; mouth was edentulous, tongue coated, slight pharyngitis was present. Lungs were normal to percussion and auscultation. The heart was normal in size; soft systolic murmur.

Chest X-ray and sputum examinations were made because of a hacking cough which appeared a few days after patient was admitted to hospital, and was somewhat troublesome. The symptoms were those of an ordinary cold and no chest signs were present, and the cough finally disappeared. Sputum March 7 was negative for tubercle bacilli; but showed a few influenza bacilli and a fair number of pneumococci. X-ray report by Dr. A. S. Holley, March 8: "Heart somewhat larger than normal, diaphragm a little higher than normal, right first rib bifurcates to form first and second ribs. Chest shows no abnormal markings."

A large tumor is found occupying the left side, extending downward to the brim of the pelvis, and a handsbreadth across the middle line. The tumor is firm, smooth, not notched on the edge. No pain is elicited on pressure. The liver is not palpable below the costal margin. The abdomen is otherwise negative. February 27 X-ray report on the stomach showed: "stomach very much distorted, oblong in shape and somewhat transverse in position." The extremities were negative except for a slight swelling of the ankles. The nervous system was negative; the genito-urinary system negative; urine negative.

SUMMARY OF BLOOD EXAMINATIONS

BEFORE OPERATION

Date	Hæmoglobin Per cent	Reds	Color Index	Whites	Polymorphonuclears Per cent	Lymphocytes Per cent	Large mononuclears Per cent	Transitionals Per cent	Eosinophile Per cent	Basophile Per cent	Aniso.	Poikilo.	Polychrom.	Nuc. reds
2–25	27	1,900,000	0.7	5,000	49	40	6	3		2	Marked	Marked	Present	0
3–7	46	2,952,000	0.8	9,300	66	32	7	3		2	Slight	Slight	Some	Fair no.
3–17	48	2,864,000	0.85	10,400	66	22	4	3		5	Some	Some	Slight	Some
3–25	50	3,322,000	0.75	6,800	76	21	2	1			All examinations for malaria neg.			
4–5	50	3,136,000	0.8	7,200	68	27	5							
4–15	45	3,312,000	0.68	7,000	47	36		17						
4–24	45	3,776,000	0.6	6,600	54	29	1	16						
5–1	60	3,360,000	0.9	7,600	60	20	4	15	1					

AFTER SPLENECTOMY MAY 16, 1920

5–20	90	4,508,000	1.	11,000	73	22	3	2			Present			
5–27	80	4,024,000	1.	19,600	70	23	2	3	1	1				
5–31	Malaria	examination negative.												
6–3	76	3,288,000	1.2	35,400	67	19	4	6	1	2	Some	Some		Malaria neg.
6–10	53	3,824,000	0.6	31,400	69	30								
6–26	56	3,225,000	0.8	28,700	61	37	2							
7–10	42	2,880,000	0.8	31,000	51	30	3	6			Slight	Slight		

The pulse rate was 80 to 90; blood pressure 120 systolic; 80 diastolic. Blood examination on day after admission to hospital showed 1,900,000 red cells, 27 per cent hæmaglobin; color index 0.7; white cells 5,000. Differential count of leucocytes 49 per cent polymorphonuclears; 40 per cent lymphocytes; 6 per cent large mononuclears; 3 per cent transitionals; 2 per cent basophiles. The smears showed marked aniso-and poikilocytosis some polychromatophilia, but no nucleated red cells. For comparison the blood examinations both pre-operative and postoperative are tabulated at the end. A diagnosis of splenic anæmia, probably Banti's disease, was made, and as the patient was not in condition to stand operation immediately, Dr. M. L. Graves was asked to take charge of the medical treatment. Dr. Graves treated patient with daily doses of Blaud's pills, sodium cacodyl., strychnine, and later cod liver oil. Early in April he added extract of red bone marrow to this. Improvement was slow but fairly steady, but the tumor showed no change in size. There was still no increase in the size of the liver. Patient was regaining strength and a little weight, but was still much emaciated. For the first month, as shown in the table, the blood picture improved rapidly but after that time it remained practically stationary, and as there was no hope of further improvement under medical treatment alone, operation was determined upon. Operation May 16, 1920. Ether by Dr. Cariker. Patient took anæsthetic well. A median incision was used. The spleen was very large, firmly adherent to the tail of the pancreas, colon and omentum, but not to the parietes. Splenectomy was done without great difficulty and with almost no loss of blood, the pedicle being tied with double chromic ligature, as were the bands of adhesions which were all very vascular. The incision was closed with chromic mattress sutures in its upper part and continuous chromic stitches in the lower part, with silkworm-gut tension and skin stitches. No drainage was used. Respiration was shallow and rapid during delivery of tumor but after that satisfactory and at the close there was no shock. The examination of the liver was cursory, as it seemed advisable not to be overlong in the operation. No abnormality was noted. Convalescence: No shock occurred after the operation and the first few days were without complications of any kind. The healing of the wound was perfect, the superficial stitches were removed on the eighth day and the deep tension stitches on the tenth day. The temperature went up to 100° on the first and 101.4° on the second day and then for three days did not go above 99°. Blood examination was made as a matter of interest on the fourth day and showed 11,000 white cells. (See table.) On May 22, the temperature went to 100.2° and for the next few days ran from 98.6° to 100.4°. The leucocytes count, May 27, was 19,600, and a careful search for possible complications was made but without finding anything to indicate infection. On May 29 the temperature reached 104.2°, but came down promptly after an enema. From this date until June 9, it ran between 97.8° and 101°, with no evidences of trouble except that a moderate enlargement of the liver made its appearance June 3 and rather rapidly increased in size. On June 9, the temperature went to 105°, and for the next 3 days remained between 100° and 104°. Throughout this period, the patient experienced no discomfort; the pulse ran between 80° and 108°, the respiration was quiet and regular, 24 to 28; there was no sign, in the general aspect, of serious illness. When the temperature was high, there was a slight headache but no chills, sweating, nor prostration. The leucocyte count was alarming; on May 31 it reached 35,400; on June 3 it had dropped to 31,400, and on June 10 was 28,700. In view of this and of the very rapid increase in the size of the liver, a possible liver abscess was considered. On June 12, the liver was aspirated in three places but nothing was withdrawn except a

few drops of bloody fluid which were thought to come from the abdominal cavity. The liver now extended to a hand's breadth below the costal margin, and was slightly tender to pressure but the abdominal muscles were relaxed. Slight distention was present but this was readily relieved by enemata. June 12 to 16, the temperature ran from 99° in the morning to 103°, the highest daily temperature being reached at 9:00 or 10:00 p.m. On June 16, the liver was again aspirated without result. From this date the temperature began to subside and was afebrile by June 23. After that date until his discharge from the hospital June 23, there was an occasional elevation to 99°, but nothing higher. About June 15 medicinal treatment, such as had been used before the operation was again instituted and there appeared to be some increase in strength and improvement in the general condition. As will be seen from the table there was not any improvement in the red cells, which were at a maximum the fourth day after operation and then gradually fell to a count lower than the last pre-operative count. There appeared to be a slight decrease in the size of the liver during the last week of the patient's stay in hospital and the tenderness over it disappeared completely. It should be mentioned that there was no evidence of ascites during the convalescent period nor was there any icterus, as evidenced by coloring of the conjunctivæ. The complete tabulation of the blood examination before and after operation is shown in table.

Pathological report on the spleen. Weight 5 pounds 9 ounces as removed, without preservation. The capsule was somewhat thick but not markedly so; smooth except for bands of adhesions near the hilus where the colon and pancreas had been bound to it. The cut surface was deep red, soft, not diffluent, not very bloody. It has much the appearance of normal splenic pulp except that the splenic corpuscles are obscured. Microscopic sections taken from the surface and from the depths of the organ have identically the same structure. There is a fair amount of hæmatogenous pigment, but this is not a noticeable feature. There is slight increase in the thickness of the fibrous trabeculæ and capsule, and the fibrous trabeculæ are rather closer together than is usual, so that there is a slight relative and a very marked absolute increase in the amount of fibrous tissue present. There is an increased number of polykaryocytes so that there is no low field that does not contain one or more of these cells and they are larger than normal and vary considerably in size. Many have the character of foreign body giant cells. Many, especially the larger, contain more nuclei than are normal and numerous mitotic figures, but these are not atypical. These polykaryocytes tend to be arranged in groups. There is a loss of contour of the splenic corpuscles, which tend to be less sharply defined from the pulp than normally, but the central artery is preserved and the corpuscles are, as a rule, easily recognized. They tend to be elongated along the length of the artery in a somewhat spindle form and the ends of the spindle tend to merge into one another. There is a slight increase in the endothelium and some desquamation of swollen endothelium. There is an increased number of normoblasts but no abnormal varieties of nucleated red cells. The red corpuscles throughout are greatly decreased and the small blood vessels contain very little blood (this despite the fact that the main vessels were ligated before the tumor was preserved and section not made until after fixation.) Throughout the entire structure are many mast cells and fibroblasts and these tend to lie adjacent to the interlacing network of fibrous trabeculæ.

Pathological diagnosis: chronic splenitis, Banti type, early stage.

After history: A report from this patient about November, 1920, states that he was feeling better and was having no discomfort, but did not regain strength. No further direct report was received, but a notice of his death appeared December 11, 1920. No details could be obtained.

PENETRATING ABDOMINAL WOUNDS

By NATHAN WINSLOW, M.D., F.A.C.S., Baltimore
From the Surgical Clinic of the University Hospital, University of Maryland

AUTHORS are too prone to publish their good results and to forget their failures. If progress is to be made in medicine failures should be recorded as well, for by this means alone will the statisticians be able to estimate properly the status of the subject under consideration. With this object in view I have undertaken to collect and collate the abdominal penetrating wounds which have been observed in the various surgical services in the University Hospital, Baltimore. Whether or no there be any visceral lesion when the missile has passed through the peritoneum, as far as this paper is concerned, the lesion is classed as a penetrating wound If in addition, during its course, a hollow or solid viscus be injured, the term perforating is employed, even though the most recent authorities restrict this designation more commonly to those injuries only involving the entire thickness of the wall of a hollow viscus If this classification be accepted, trauma of the solid organ is spoken of as incised, lacerated, punctured, etc. The purpose of this contribution is to emphasize the importance of a thorough abdominal exploration when in doubt as to whether the peritoneal cavity has been entered or not. In all bullet wounds, no matter how remote the point of entrance, when abdominal symptoms arise the abdominal viscera should be inspected. If no damage to the intra-abdominal structures has been done, the patient has only been put to a temporary inconvenience; whereas if a hollow viscus be injured a life may be saved which otherwise would have been sacrificed. A laparotomy is called for with especial force, if the wound is located in the lower chest or far down in the abdomen. The results obtained in this class of cases in a large metropolitan hospital should be of interest to the profession.

Case 1. A. K., a colored female, of Baltimore; age 30; housework, was admitted to the University Hospital, May 20, 1917, at 10 a.m., for a gunshot wound of the abdomen incurred an hour earlier. When brought to the hospital she was much shocked, so was immediately stimulated. Examination revealed a bullet wound in the right side of the abdomen several inches from the midline and on a level with the umbilicus. Her abdomen was markedly distended and tender to the touch. The belly wall was rigid throughout. In addition there was a second bullet hole in the right buttock and she was bleeding from the vagina. The temperature was 96° F., pulse 68, respiration 20.

Operation, May 20, 1917, ether anæsthesia, iodine technique—enterorrhaphy, resection of ileum, end-to-end anastamosis—died.

The abdomen was opened through a mid-line incision. On entering the peritoneal cavity, it was found filled with free blood. This was mopped out. Further search revealed twelve holes in the ileum and eight in the mesentery. Nine of the holes in the intestine and the eight in the mesentery were closed with fine silk sutures. Three of the holes in the small gut were so close together and the bowel so badly torn that 3 inches of the intestine had to be resected. The continuity of the intestinal canal was restored by means of a Murphy button end-to-end anastomosis. The patient was now very much shocked so the operation was concluded by the insertion of two rubber tubes and four cigarette drains into the pelvic basin and the abdominal wall closed in tiers down to the drains. The woman did very well until June 14, 1917, when she began to vomit frequently and persistently. She lost ground steadily, and daily became weaker and weaker. Though assiduously stimulated she failed to rally and died June 28, 1917.

The Murphy button was passed June 14, 1917. From operation to date of death temperature was never normal, both night and morning indicating that there was some absorption going on. The temperature oscillated between normal and 104, the pulse 90 and 160, the respiration 20 and 40. Death was attributed to (1) bronchopneumonia, (2) toxæmia, (3) exhaustion.

Case 2. E. O., colored, female of Baltimore; laundress; age 33, was admitted to the University Hospital, September 11, 1917, with the complaint of a gunshot wound of the abdomen. She stated that while walking in the street she was shot by a man from the opposite side of the street. The accident occurred about 2 p.m. and she was rushed by the police patrol to the hospital. On admission she was suffering considerable abdominal pain. The abdomen was exquisitely tender throughout and the abdominal muscles were tense and rigid. The wound of entrance was on the left thigh immediately above the great trochanter and a little to its outer side. The bullet finally came to rest in the right iliac region just beneath the skin, so must have

coursed through the abdominal cavity transversely and slightly upward.

Operation, September 11, 1917, 3 p.m., ether anæsthesia, iodine technique—suture of perforated ileum and drainage of urinary bladder—recovered.

The abdominal viscera were approached by a left rectus incision. On opening the peritoneum, a small amount of bloody fluid was found in the abdominal cavity. This was mopped out with sponges. Investigation of the alimentary canal revealed two perforations in the ileum. These were closed with intestinal silk. Further search demonstrated a hole in the urinary bladder. A rubber tube was inserted into the rent, and the bladder sutured around it. As the remainder of the abdominal contents were found to be uninjured, the operation was concluded by placing two cigarette drains to the pelvic floor and closing the abdominal wall in layers up to the point of emergence of the drains. With the exception of the development of an abscess in the left buttock which was incised and drained September 17, the woman made an uneventful recovery. She was discharged October 17, 1917, cured. Her bowels were moving regularly and she voided urine without trouble.

Case 3. W. S., colored; male, of Maryland; age 35; laborer; was admitted to the University Hospital, September 30, 1917, for a gunshot wound of the abdomen. He was shot about 4 p.m. and received at the hospital around 7 p.m. He was in fair condition. The bullet entered the back over the right kidney and ranged forward and upward as indicated by the point of exit a little below and to the outer side of the right nipple. The temperature was 97°, pulse 80, respiration 24. The abdominal wall was quite rigid and tender throughout. It was evident that the peritoneal cavity had been penetrated, so operation was advised and accepted.

Operation, September 30, 1917, 8 p.m., ether anæsthesia, iodine technique—laparotomy and drainage—recovered.

The abdomen was entered by means of a right rectus incision. On opening the peritoneum, a small amount of free blood was found among the coils of the intestines. This was mopped out. Inspection of the liver revealed a perforating hole through the central portion of the right lobe, the ball having passed through the upper pole of the right kidney before entering the peritoneal cavity. So drains were placed in the right renal fossa and in the hole in the liver and the wound closed in the usual way. The patient was then placed on his left side, iodinized and properly draped and an incision extending from the last rib above downward to the crest of the ilium, thereby exposing the kidney. This disclosed a large hole in the upper pole of the kidney and a considerable amount of blood clot in the perirenal structures. After wiping out the blood, drainage was placed down to the wound in the kidney and the rest of the wound closed. In order to guard against lock-jaw a prophylactic administration of antitetanic serum was administered before the patient was returned to the ward. He stood the operation well and was returned to his bed in very good condition. The postoperative course was extremely smooth and the patient left the hospital November 11, 1917. The wound in his back was entirely healed, the one in front discharging but slightly. He was in good condition and pronounced recovered.

Case 4. J. K., colored; male; of Baltimore, age 24; stevedore; was admitted to the University Hospital, at 1 p.m., November 10, 1918, with the history of having been shot an hour earlier, in the abdomen.

When he was received in the hospital he evidenced signs of acute internal hæmorrhage. The wound of entrance was a little above the umbilicus and to the left of the mid-line. The abdominal muscles were rigid throughout and very tender to the touch. He was pale and in a state of collapse.

Operation, November 10, 1918, 2 p.m., ether anæsthesia, iodine technique—suture of the small intestine, colon, and mesentery—died.

The patient was on the operating table within an hour after admission to the hospital. The abdominal cavity was approached through a right rectus incision. On opening the peritoneum, a large quantity of blood escaped. This was found to be issuing from an injured vessel in the mesentery of the small intestine which was still actively bleeding. This hæmorrhage was controlled by introduction of a mattress suture of intestinal silk. The peritoneal cavity was then mopped dry and a further search instituted for other damage. This investigation revealed the presence of five perforations in the jejunum and two in the transverse colon, which holes were closed with fine silk sutures. Other than the aforementioned, no further damage could be detected. A small incision was then made above the pubes, through which a rubber tube and a cigarette drain were inserted into the pelvis. Still another cigarette wick was introduced through the upper incision. This likewise terminated in the pelvis. The abdominal wall was closed with chromic catgut in tiers, a tract being left for the mergence of the drain. The patient was returned to the ward in fair condition. He did well until about 6:30 p.m., then went into collapse, from which he did not react, and died at 9 p.m., November 10, 1918.

Case 5. B. S., white; female; age 8, school-girl was admitted to the University Hospital, December 15, 1918, with the history of having been shot in the stomach by her little brother. She was lying on a couch, all covered up and her brother not knowing that she was there discharged a cat and rat rifle at the couch inflicting a wound in his sister's abdomen. She was brought immediately to the hospital arriving that afternoon 2 hours after the accident. Examination revealed a bullet wound in the abdomen about an inch from, and to the left of, the median line. There was no evidence of external hæmorrhage. The patient was pale, and her pulse was rapid. The abdominal muscles especially in the upper segment were rigid and very tender to the touch.

Operation, December 15, 1918, 7 p.m., ether anæsthesia, iodine technique—laparotomy and drainage—recovered.

The abdominal cavity was reached by a right rectus incision. On opening the peritoneal cavity it was seen that the bullet had furrowed the anterior surface of the liver and lacerated Glisson's capsule. The trough was not deep and there was but little oozing. In passing the hand over the upper surface of the liver, a 22 caliber bullet covered with particles of clothing, was recovered. The other viscera were found to be uninjured. Therefore, a small stab wound was made close above the pubes through which a rubber tube was carried into the pelvic basin. Through the original wound a tube was placed in the subhepatic space and a cigarette wick on the anterior surface of the liver. This wound was then closed with the exception of the drainage tract. The patient was returned to the ward in fair condition and made a smooth and unruffled recovery, being discharged cured, January 4, 1919.

Case 6. R. B., white; male, age 26; clerk; was admitted to the University Hospital, February 2, 1919, with the complaint of a gunshot wound of the abdomen. He sought relief for a bullet wound accidentally received at 2 a.m. while standing on the sidewalk at Baltimore and Pine streets. The wound of entrance was in the sixth intercostal space in front. There was no wound of exit. His appearance indicated internal hæmorrhage. The temperature was 99°, pulse 98, respiration 34. He was restless. The abdominal wall was rigid especially in its upper portion. It was thought that he had a bullet wound of the liver and perhaps of the pleura and lungs as on sponging the external wound little bubbles of air were mixed with the escaping blood.

Operation, February 2, 1919, 4 a.m., ether anæsthesia, iodine technique—incision and drainage—died.

The abdominal cavity was reached through a high right rectus incision. When the peritoneum was opened a large quantity of free blood was seen lying between the coils of the intestines. This was cleaned out. On inserting the hand between the ribs and the dome of the liver, a lacerated wound was felt in the anterior surface of the liver. The damage was high up and quite inaccessible. A hole was also located penetrating the diaphragm. On account of the position of the wound it was considered inadvisable to prolong the operation in an attempt at suture, the accomplishment of which would require rib resection, so a cigarette drain was introduced to the hole in the diaphragm, in its journey coursing between the liver and the ribs. Additional drains were placed in the subhepatic space. A small incision was then made above the pubes, and a rubber tube carried into the pelvis. The abdominal wall was closed in tiers. Patient returned to ward in fair condition. Bullet not found; probably lodged in the liver.

February 3, 1919. Since operation the patient has gotten progressively worse. The pulse has become weaker and weaker. His abdominal cavity is draining freely, for the most part, serum. In spite of stimulants and supportive treatment he died. No cause for the death was discovered.

Case 7. L. K., white; male; age 19, no occupation; was brought to the University Hospital, February 12, 1919 with the history of having been shot in the back. There was a bullet wound in the right side of the back from which a small amount of blood was escaping. Anteriorly in the sixth interspace on the right side a foreign body could be palpated beneath the skin. The patient's abdomen was rigid and tender. The symtoms indicated internal hæmorrhage.

Operation, February 12, 1919, ether anæsthesia, iodine technique—exploratory laparotomy, drainage—cured.

He was taken to the operating clinic within 2 hours after the injury, and the abdomen entered by a high right rectus incision. On opening the peritoneum a large quantity of blood escaped. No wounds could be seen in the stomach or intestines, but on the anterior surface of the liver high up under the diaphragm was a bullet wound. Owing to the inaccessibility of the wound and the patient not being in very good condition, no attempt was made to suture the laceration. A cigarette drain was placed immediately over the opening in the liver, a rubber tube and several cigarette wicks in the subhepatic space, and a small tube in the pelvis through a counter incision above the pubes. The abdominal incision was closed to drains, and patient returned to bed in fair condition.

March 4, since the operation the patient has been running a more or less irregular course, the rises and falls in temperature giving one the impression of the presence of suppuration. The abdominal incision is draining pus freely. Examination of the chest shows marked dullness on the right side and fluid is suspected. An aspirating needle was inserted but no fluid obtained. The patient continued to run an irregular temperature until March 15, when the aspirating needle was again inserted in the right side of the chest, where there were suggestions of a collection of fluid, and a small quantity of clear fluid was obtained. From that time the patient improved slowly but steadily and was discharged from the hospital, April 6, 1919, cured.

Case 8. R. T., colored; male; 17; laborer; of Baltimore; was shot at 7 p.m., October 19, 1919, and admitted to the University Hospital at 9 p.m. The injury was accidental and caused by a 32 cal. pistol ball. The missile entered the right side of the abdomen coming from a pistol in the hands of a man to the right and slightly to the rear of the patient. Operation October 19, 1919, ether anæsthesia, iodine technique—enterorrhaphy—pneumonia, cured.

The abdomen was entered through an incision along the right linea semilunaris. An injured area was found on the transverse colon but probably it did not perforate the bowel. The small intestine was also injured in two places without perforation. All three of the weak spots were sutured as precautionary measures against future rupture. No other damage could be found. There was no free

blood in the peritoneal cavity. The abdominal wall was closed with catgut without drainage. At the close of the operation, the patient was in good condition. One thousand five hundred units of antitetanic serum was administered. Although this would have seemed a most favorable case for a rapid and speedy recovery, the man developed a frank penumonia of the lower lobe of the left side. This complication ran a typical course and had cleared up by October 29. The man was becoming impatient and refused to remain in the hospital any longer so was discharged November 2, 1919. The temperature was normal, the incision entirely healed and chest negative. A fluoroscopic examination located the bullet lodged in the posterior part of his pelvis on the left side.

CASE 9. H. R. B., white, male; age 16; painter; of Maryland, entered the University Hospital, Baltimore, November 13, 1919, at 4 p.m., for gunshot wound of the abdomen. He gave a history of having been shot in the abdomen 2 hours earlier. He said he had been resting on a stump with the muzzle of a shotgun against his abdomen, when on arising in some mysterious way the load was discharged. He was in profound shock, pulse rapid, 140 to the minute, the respirations were sighing and thoracic in character. The abdominal muscles were very tender and he resisted all attempts at palpation. The abdomen was not distended. To the right of the mid-line and just below the umbilicus was a wound which was somewhat larger than a silver dollar.

Operation, November 13, 1919, iodine technique, ether anæsthesia—enterorrhaphy—died.

A right rectus incision was made between the wound and the median line for the purpose of exploration. When the peritoneal cavity was opened a large quantity of blood escaped and hissing of air was heard. The large intestine was inspected and four perforations found; two in the transverse and two in the upper part of the ascending colon. These perforations were closed. The small intestine showed no evidence of injury. Further investigation developed a wound in the liver sufficiently large to admit a small-sized fist. Pieces of clothing and gun-wadding were felt in the depths of the hole. These were extracted. As the boy's condition was precarious, no attempt was made to suture this wound which was large and ugly; instead the rent was stuffed with gauze. Other drainage was placed in the subhepatic space, and the pelvis and the wound closed down to the drainage track. The patient was returned to bed in a badly shocked condition and no hope for cure. He died at 6:40 p.m.

CASE 10. W. G., male; colored; age 29, chauffeur; of Baltimore, was wheeled into the ward at 10 a.m., November 28, 1919, with a gunshot wound of the abdomen. He was shot about 7:30 a.m., by a man with whom he had no acquaintance, because of the refusal of the loan of some money. Examination showed a penetrating gunshot wound in the right upper abdomen, below the eleventh rib. The patient was in much pain and his abdomen in its entire extent was very tender and rigid. The wound of entrance was anterior and just below the costal margin. The abdomen was moderately distended. Neither pulse nor appearance suggested internal hæmorrhage. He could give no clear statement concerning the direction of the bullet. No bile escaped from the wound. The impression was penetrating wound of the abdomen with probable injury to the ascending colon from gunshot wound.

Operation, November 28, 1919, ether anæsthesia, iodine technique—exploratory laparotomy, no drainage—cured.

The abdomen was entered by a right rectus incision somewhat to the inner side of the wound of entrance. There was a contusion of the anterior wall of the stomach in the neighborhood of the pylorus, but apparently no penetration. The liver was wounded in two places in its margin. No further damage was found. The bullet evidently left the peritoneal cavity through the suspensory ligament of the liver. No hæmorrhage was present. No drains were used, but the abdomen was closed tight. The postoperative course of the patient was smooth. He made a good recovery and was discharged from the hospital December 12, 1919.

CASE 11. C. S.; colored; female, housewife; age 21, of Baltimore, was admitted to the University Hospital, around 1 a.m. January 19, 1920, for a pistol wound of the abdomen received an hour earlier. The pain in her abdomen was so intense as to cause her to cry out. She was intensely shocked from bleeding into her peritoneal cavity. The abdomen was distended, tense, boardlike, tympanitic in front but dull in the flanks. It was tender throughout. There was a small wound of entrance in the lower right quadrant. A catheterized specimen of urine showed no blood.

Operation, January 19, 1920, 3 a.m., ether anæsthesia, iodine technique—enterorrhaphy—died.

The abdominal cavity was entered through the right rectus route. When the peritoneum was opened about 1,200 cubic centimeters of free blood, including some large clots, was found in the abdominal cavity. The chief source of the bleeding was a torn vessel in the mesentery of the ileum. This was arrested by a silk suture and the belly mopped clean. Besides this damage there were ten perforations in the ileum from which fæcal matter was oozing and soiling the peritoneum. These varied in diameter from 1/8 to 3/8 of an inch. All of the holes were closed by mattress sutures reinforced by a row of interrupted silk sutures. As far as could be determined no further damage had been done the small intestine. The cæcum, sigmoid, and rectum were undamaged. The bullet was not located. After the introduction of ample drainage, both into the general peritoneal and pelvic cavities, the abdomen was closed down to the drains. As the patient was in very poor shape at the conclusion of the operation, an incision was made down to the median basilic vein and 600 cubic centimeters of

normal salt solution introduced into the circulation. Though actively stimulated, the woman's condition became worse after the operation and she gradually sank without reacting and died at 2 a.m., January, 20, 1920.

CASE 12. W. S., white; male; age 19; ex U. S. marine; shot himself about 6 p.m., March 9, 1920. He was admitted to the University Hospital the same evening at 7 p.m. Examination revealed a bullet wound in the left side of the thorax in the seventh interspace and a half inch to the inner side of the nipple line. The bullet lodged in the muscles of the back behind the lower ribs where it could be felt. The abdomen was rigid, especially in the upper quadrant. It was distended and somewhat tender to pressure. During the examination the patient vomited a small quantity of blood mixed with stomach contents. The breathing was distinctly thoracic. There were no symptoms of lung injury. Obviously his stomach had been perforated. He was in good condition. His pulse was fair and he was not greatly shocked. There were no signs of internal hæmorrhage.

Operation, March 9, 1920, 9 p.m., ether anæsthesia, iodine technique — gastrorrhaphy—pneumonia, cured.

On opening the peritoneal cavity, some free blood was detected. This was found to be issuing from a perforating wound in the left lobe of the liver, the wound of entrance was sutured, that of emergence on the under surface of the organ was packed with gauze. Examination of the anterior wall of the stomach revealed a hole located about 2 inches from the pylorus and near the lesser curvature. This was closed by a purse-string suture which was reinforced by a line of Lemberts. Further search revealed, to the left of the œsophagus, a hole in the diaphragm through which air was being aspirated into the thoracic cavity. This hole was sealed by interrupted sutures of fine silk. The stomach was then delivered, a hole made in the mesocolon, and the posterior wall of the stomach searched for injury. Here a perforation was detected in a location corresponding to the wound in the anterior wall. This was closed by two layers of interrupted sutures. The opening in the mesocolon was closed, and drainage of the lesser peritoneal cavity obtained through the gastrocolic omentum by rubber tubage. Fortunately for the patient he had not eaten since morning and there had been comparatively little seepage into either the general or lesser peritoneal cavity. There was no pus in the peritoneal cavity, but a plastic peritonitis had already set in. Though the boy was in fair condition, it was thought best not to prolong the operation by a search for the bullet. Convalescence was rather stormy, a bronchopneumonia supervened, and the abdominal wall suppurated, but the patient eventually threw off these infections and was discharged from the hospital 5 weeks after admission.

CASE 13. J. M., white; male; age 71; farmer, of Maryland; was admitted to the University Hospital, March 20, 1920, about 2:30 p.m., in a semiconscious condition. He was brought in for relief of a gunshot wound of the abdomen received about 48 hours prior to entrance to the hospital. He was unable to answer questions intelligently but complained bitterly of pain. Two gunshot wounds were visible, one of entrance in the right upper quadrant and another in the left hypogastric region. He resented palpation. There was marked abdominal rigidity. The belly wall though hard was but slightly distended. Liver dullness was present. He did not vomit after admission to the hospital.

Operation, March 20, 1920, ether anæsthesia, iodine technique—exploratory laparotomy, drainage —died.

A laparotomy was made through the mid-line for the purpose of exploring the damage. The abdomen was full of bloody matter and the viscera in the upper right quadrant were tied up by many adhesions. A large hole was found in the hepatic flexure of the colon. Through the vent thus created fæcal material was freely pouring. As the intestine was too necrotic to suture and the patient in such a forlorn condition, a rubber tube was inserted in the aperture and the gut attached to the parietal peritoneum. This procedure, with free drainage of the peritoneal cavity, had to be relied upon to pull the man through. Tucks and tubes were placed in the upper abdomen and the right lumbar regions and additional drains in the pelvis through a suprapubic stab. The man failed to rally, however, and died March 21, 1920. Autopsy showed a bullet wound ½ inch below the cartilage of the seventh rib and 2½ inches to the right of the ensiform cartilage and a second bullet wound in the left lower quadrant. This wound did not enter the peritoneal cavity. There was an abundant exudate on and between the coils of the intestines. The death was attributed to a generalized peritonitis from a perforating gunshot wound of the ascending colon.

CASE 14. E. B., colored; female; age 18; housework; sought the University Hospital, about 5 p.m., June 23, 1920, for relief of a gunshot wound of the right arm and abdomen. The wound in the right arm consisted in the point of entrance solely. The ball struck and shattered the humerus about the mid point. About halfway between the crest of the ilium and the last rib there was another hole, a little posterior to the mid-axillary line. On the opposite side of the abdomen, but slightly anterior to the mid-axillary line over the tenth rib, a similar opening could be seen. The woman was in a condition of shock, the abdomen boardlike and tender, and, as she was evidently bleeding internally, an exploratory laparotomy was suggested and accepted.

Operation, June 23, 1920, 6:30 p.m., ether anæsthesia, iodine technique—gastrorrhaphy—died.

The abdomen was opened slightly to the right of the mid-line through the sheath of the right rectus muscle. The abdominal cavity was found to contain a large quantity of free blood, especially about the right kidney fossa. A large, jagged opening was found in the peritoneum just at the outer border of

the right kidney. The bullet then entered the right lobe of the liver and followed a course from the left to the right and at a slight angle from behind forward. The wound in the liver was bleeding profusely. This was tightly packed with gauze, as the liver substance was too lacerated to suture. In its further course the ball perforated both walls of the stomach a slight distance from its lesser curvature and about the mid point. The openings in the stomach were closed, the one in the posterior wall being reached by an opening through the transverse mesocolon. The spleen, and both kidneys escaped injury. The entire intestinal tract was examined without the detection of any further damage. The pelvis was full of a sanguinous fluid. Some stomach contents also were found in the peritoneal cavity. The woman left the table in a condition of extreme shock and died about 10 p.m., June 23, 1920, without regaining consciousness.

CASE 15. M. R., colored; male; age 32; chauffeur, of Baltimore; was brought to the University Hospital at 7:50 p.m., November 14, 1920, for a pistol wound of the abdomen. The wound of entrance was in the epigastrium about 1½ inches to the left of the mid-line, and somewhat above the level of the umbilicus. There was no point of exit, but the ball could be felt lying just above the anterior spine of the right ilium. He was in good condition. The pulse was 88. An hour later the pulse had run up to 104, and the abdomen had become quite rigid. After admission he vomited, but the vomitus contained no blood.

Operation, November 14, 1920, 9:40 p.m., ether anæsthesia, iodine technique, gastrorrhaphy, cured.

The abdomen was entered through a high right rectus incision. Upon opening the peritoneum a quantity of liquid blood escaped. Two perforations were found in the anterior wall of the stomach. These were sutured with fine silk. The other viscera were thoroughly examined, but no other damage was found. A rubber tube with exit through a suprapubic wound was placed in the pelvis and appropriate drainage in the subhepatic space in close proximity to the stomach. After closure of the wound the man was returned to the ward in good condition. He made an uneventful recovery, and was discharged cured December 26, 1920.

CASE 16. J. D., colored; male; laborer; age 28; of Baltimore; was admitted to the hospital at 12:30 a.m., December 25, 1920, for a pistol wound of the upper abdomen received about a half hour earlier. The point of entrance was immediately below the right costal margin and about 2 inches from the mid-line. The bullet could be felt on the left side, just below the costal margin, about 6 inches from the mid-line. There was very little muscular rigidity, if any; no nausea or vomiting. The temperature was 98.6°, pulse 90, mentality clear, no signs of shock, slight pain. The general condition was good. It was thought at entrance that bullet had not penetrated peritoneal cavity but examination clearly indicated penetration and probable perforation of a viscus.

Operation, December 25, 1920, 12:30 a.m., ether anæsthesia, iodine technique — gastrorrhaphy — cured.

The abdomen was entered through a mid-line incision. On opening the peritoneum a small amount of bloody serum was seen in the upper abdomen among the coils of the viscera. Two perforations were found in the stomach near the greater curvature. The point of entrance of the bullet into the stomach was about 4 inches from the pylorus and to the left. It left the organ 4 inches farther to the left. It had evidently entered and passed out of the stomach in a straight line, and traveled from right to left. There was a slight amount of free blood in the abdominal cavity, but no intestinal contents had leaked through the hole. The perforations were closed with a double row of silk Lembert sutures. A tube drain was inserted into the left renal fossa and two cigarette drains were inserted through the abdominal wall to the right of perforations. The patient left the operating room in excellent condition. The convalescence was smooth but when an attempt was made to remove the rubber tube it was found to be firmly fixed; so on January 11, 1921, a left McBurney incision was made. A finger inserted through this opening could feel the tube caught in a mass of omentum, which had apparently twisted itself around the tube and gave to the mass a bulbous shape. The mass was straightened out by a finger in the abdomen and drawn into the wound. The tube was then easily extracted. The McBurney incision was closed without drainage. Discharged January 24, 1921, with all wounds healed except a small granulating area at site of drains.

CASE 17. This patient, a colored man; H. D., age 34; single; laborer; was admitted to University Hospital, December 13, 1920, at 8 a.m., with the complaint of having been accidentally shot in the left side, at 8 p.m., the preceding night, by a friend who was cleaning a pistol. The bullet traveled about 4 feet before striking him. On admission to the hospital, 12 hours after the accident, he was in a state of collapse, his legs were drawn up, his facies was anxious, his pulse rapid collapsed, of poor volume and tension. His abdomen was rigid, painful and tender throughout, and dull on percussion. The hole of entrance was located in the upper left abdominal quadrant, 1 inch below the tenth costal margin in the mid-axillary line. No wound of exit could be seen anywhere. He voided his urine voluntarily, but passed nearly pure blood. The quantity was small. On admission his temperature was 97°, pulse 120, respiration 22. The clinical impression was (1) gunshot wound of the abdomen; (2) internal hæmorrhage; (3) perforations of the hollow viscera including the urinary bladder.

Operation, December 13, 1920, ether anæsthesia, iodine technique — enterorrhaphy — gas infection, died.

The peritoneal cavity was entered through a long left rectus incision. Upon opening the cavity a large quantity of blood was found and mopped out. No

active bleeding was detected, but five perforations of the small intestine, one of the mesentery and one into the urinary bladder, were found and closed. Drainage was obtained by two rubber tubes and four cigarette wicks. The abdominal incision was closed in tiers down to the drains. The man left the table in poor condition. He did not rally after being returned to bed and died suddenly at 8:40 a.m., December 15, 1920. The temperature varied between 97 and 101° F., pulse 90 and 130, respiration 20 and 45.

Autopsy: The body crepitated over both the upper and lower extremities. The usual incision from the suprasternal notch to the symphysis pubis revealed gas containing subcutaneous tissue. The epicardium contained gas beneath its structure. There were a few little gas bubbles seen at intervals in the liver. The urinary bladder showed a sutured wound. The small intestine a number of sutured perforations. The bullet was found lodged in the soft tissues in the neighborhood of the prostate. It was recovered.

Causes of death: (1) hæmorrhage; (2) acute suppurative peritonitis; (3) sepsis from gas infection due to pistol bullet. The bacillus aerogenes capsulatus was grown from the débris in the cavity of the heart.

CASE 18. C. S., white; male; mechanic; aged 29; of Maryland; came to the University Hospital, June 1, 1921, with the complaint of a gunshot wound of the chest and abdomen. The point of entrance of the missile was above the right seventh rib, the point of exit on the same level just posterior to the posterior axillary line. The man was somewhat shocked and suffering some pain. His respirations were jerky, catchy, and rapid. The abdominal muscles were very rigid. There was no evidence of pneumothorax, hæmothorax or marked intra-abdominal hæmorrhage. It was supposed that the bullet had traversed the costophrenic recess and passed through the diaphragm and liver, so exploratory incision was advised and accepted.

Operation, June 1, 1921, 8 p.m., ether anæsthesia, iodine technique—exploratory laparotomy, drainage—cured.

The injury was incurred about 4 p.m., so the patient was under operation about 4 hours after the wound was received. Access was gained to the peritoneal cavity through a high right rectus incision. It was found to contain no free blood. However the bullet had cut a gutter in the superior surface of the liver. No other abdominal viscera were injured. A rubber tube was placed in the wound in the liver and brought out through the track made by the bullet posteriorly. Two cigarette drains were placed through the operative wound; one in the renal fossa and one between the liver and the diaphragm. The man made an uneventful recovery and was discharged June 29, 1921, entirely well.

CASE 19. G. W., colored, laborer; male; age 25; of Baltimore; was admitted to the University Hospital about 10 p.m., June 20, 1921, with a gunshot wound of the abdomen. The bullet entered the belly in the right lumbar region about 2 inches above the posterior superior spine. Pain, shock, the location of the wound and generalized abdominal tenderness left no choice other than an exploratory laparotomy.

Operation, June 20, 1921, 10:30 p.m., ether anæsthesia, iodine technique—suture of the liver, gastrorrhaphy—peritonitis, died.

Admittance to the abdominal viscera was obtained through a right rectus incision. About a pint of free blood was discovered in the pelvis and lesser amount in the lesser peritoneal cavity. A laceration in the right lobe of the liver was gaping and bleeding profusely. Suture of this wound checked the further escape of blood from the torn liver vessel. A wound 3 inches long in the anterior wall of the stomach in close proximity to the pylorus was closed by mattress sutures of silk, reinforced by a continuous Lembert. The entire intestinal track was traced for perforation but none found. Two rubber tubes were carried into the lesser peritoneal cavity, four cigarette drains in the upper right quadrant, and one tube and two cigarette wicks to the pelvis. Particles of food such as meat, peas, and potatoes were scattered throughout the peritoneal cavity. The detritus was cleaned out as well as possible. With the closure of the wound and the draping of the wound completed, the patient was returned to the ward in but fair condition.

The morning following the wound was draining freely, the drainage consisting to a large extent of bile. The abdomen was fairly rigid but not distended. No radial pulse could be found. The femorals were beating at the rate of 160 per minute. Though the patient was conscious, he was failing rapidly and died at 11 a.m., June 21, 1921. Autopsy revealed a hole in the under surface of the duodenum overlooked at operation, through which intestinal contents were leaking, and a coexistent peritonitis.

CASE 20. A. S., white; female; age 28; housewife, of Baltimore; entered the University Hospital, January 3, 1921, suffering with a gunshot wound of the abdomen. The wound of entrance was at the edge of the costal margin on a level with a point 2 inches below the xiphoid process and to the right. The shooting occurred about 11 a.m. and the patient was admitted at noon. She was greatly shocked and complained of intense abdominal pain. A catheterized specimen of urine was clear. She vomited copiously but the ejecta contained no blood.

Operation, January 3, 1921, 1:30 p.m., ether anæsthesia, iodine technique—exploratory laparotomy, drainage, overlooked hole in the sigmoid, perforated liver and pancreas—pneumonia, peritonitis, died.

The peritoneum was opened through a right rectus incision extending from the chondral margin to the umbilicus. On incising the peritoneum a large amount of free blood and some clots were seen. These were limited mostly to the lesser peritoneal cavity. It was seen that the bullet had passed entirely through the right lobe of the liver. Bleeding

from this wound had ceased. There was also a hole in the lesser omentum and a perforation through the body of the pancreas. The wound in the latter organ was still actively bleeding. There was no evidence of injury to the retroperitoneal vessels, nor to the left ureter or kidney. The entire small intestine was eviscerated without result. A hole was found in the transverse mesocolon, but there was no bleeding at this point. No perforation could be found in either the transverse or descending colon. There was, however, considerable emphysema of the mesentery of the sigmoid, but no hæmorrhage from, nor injury to, the sigmoid could be demonstrated. Examination of the pelvic organs showed the uterus to be the size of a 3 months' pregnancy. After the institution of appropriate drainage and the closure of the wound with the exception of the path through which the drains emerged the patient was returned to her ward. She was only in fair condition. The patient did not do well and died at 1:25 a.m., January 7, 1921.

Autopsy revealed a pin hole in the under surface of the sigmoid through which liquid intestinal contents were escaping and a co-existing generalized peritonitis, and bronchopneumonia.

CASE 21. G. L., colored, male; laborer; age 33; of Maryland; was brought to the University hospital about 8 p.m., April 9, 1921, with the history of having been shot in the abdomen at 5:30 p.m. Examination showed a bullet wound just below the costal margin and 4 inches from the mid-line on the left side. In the left side of the back just beneath the skin, between the ilium and ribs, the bullet was felt. The patient was unable to walk. He was suffering intense pain. The abdominal wall was very tense, rigid, and painful to touch throughout its entire extent.

Operation, April 9, 1921, ether anæsthesia, iodine technique—enterorrhaphy—died. The abdomen was entered through a left rectus incision. On opening the peritoneum, a moderate amount of blood escaped. The stomach was examined and found to be intact. Seven perforations were found in the ileum and one in the transverse colon near the splenic flexure. All of these holes were closed with fine silk. Examination of the entire intestinal tract failed to disclose any other damage. Drainage of the pelvis was obtained through a stab wound above the pubis, the general peritoneal cavity by cigarette tucks through the abdominal incision. The patient was returned to bed in fair condition. He did not do well after operation carrying a temperature varying between 98° and 103° and died April 14, 1921.

The autopsy revealed peritonitis as the cause of death.

CASE 22. J. H., white; male; laborer; age 44; of Baltimore; was admitted to the University Hospital in a delirious condition with the history of a gunshot wound of the abdomen. Examination showed the patient to be in a markedly shocked condition. The radial pulse could not be obtained. The skin was cold and clammy and the patient was covered with a cold sweat. The hole of entrance was located on the right side just above the anterior, superior spine; that of exit just below the great trochanter of the left side. The man was infused before being taken to the operating room.

Operation, May 17, 1921, ether anæsthesia, iodine technique—resection of the ileum—died.

A right rectus incision permitted an inspection of the damage done. This revealed a laceration of the parietal peritoneum just above the right iliac vessels and of the parietal peritoneum on the left side immediately beneath the iliac vessels. The peritoneal cavity as suspected was full of blood, both free and clotted. The mesentery supplying the ileum was badly shattered and the ileum itself was torn so extensively as to make a resection imperative. Restoration of the continuity of the bowel was obtained by means of the Murphy button. Drainage was obtained by cigarette tucks and rubber tubes to the general and pelvic peritoneum. After the incision was closed, and before the patient was returned to his bed, a prophylactic injection of antitetanic serum was administered. The man never recovered from his collapse and died several hours after the completion of the operation. The autopsy revealed nothing of interest. Death was attributed to exhaustion from internal hæmorrhage following a gunshot wound of the abdomen.

CASE 23. D. B., colored; male; schoolboy, age 6; of Baltimore; was admitted to the University Hospital, July 4, 1921, for a gunshot wound of the abdomen. He gave the history of having been shot with a stray bullet while walking in the street. On admission he had an anxious expression, but was apparently in no great pain. His pulse was 80, respiration 20, temperature 100°. The rectus muscles were rigid and the thighs were flexed on the abdomen. Examination showed a gunshot wound about 2 inches below the level of the umbilicus and about an inch external to and to the right of the mid-line, from which at least 6 inches of omentum was protruding. No wound of exit could be found. The voided specimen of urine was negative for blood.

Operation, July 4, 1921, ether anæsthesia, iodine technique—enterorrhaphy—died.

The abdomen was entered through a right rectus incision. The original wound and protruding omentum was not disturbed. The projecting omentum was cut off at its base and pulled through the bullet wound. The base was ligated and treated with alcohol and allowed to fall back into the peritoneal cavity. There was to be seen about 4 ounces of free blood in the peritoneal cavity. The gastro-intestinal tract was traced from the stomach to the rectum. A perforation was found in the ileum about 16 inches from the ileocæcal valve. This was closed with a pursestring suture of fine silk, and the line of suture reinforced with a continuous Lembert. There were two perforations in the cæcum, one in its anterior and one in its posterior wall. Both wounds were on the appendiceal side of the ileo-

cæcal valve. Both were closed by two rows of sutures. The bullet left the peritoneal cavity behind the cæcum and just external to the internal iliac vessels. As no other injury to the abdominal viscera could be found, appropriate drainage was instituted, the incision closed as far as possible, and the patient returned to the ward in fair condition.

The postoperative course of this patient was stormy and unfortunate. He first threw off a bronchopneumonia; then his wound broke down; and finally he developed a fæcal fistula, and died July 24, 1921, at 6:30 a.m., of inanition.

CASE 24. N. T., colored; male; age 25; of Maryland; stabbed July 3, 1917, at 11:30 p.m., on the operating table at 12:45 a.m., returned to the ward at 1:45 a.m., and died at 4:45 p.m., July 4, 1917.

He was brought to the hospital in an ambulance with the history of having been stabbed in the abdomen 4 days previously. He had received first aid and at the time of his reception at the hospital had a dressing on the wound. He was suffering but little pain. His temperature was 99 3/5, pulse 104, respiration 32. His general condition was poor and little hope was held out for his recovery. After being placed in bed, examination revealed a somewhat painful and tender abdomen, rapid and shallow respirations, a quickened and small pulse, an anxious facies. Over the left lateral wall of the abdomen was a wound which admitted the tips of two fingers. It was discharging a very foul smelling, bloody serum. The abdominal walls were very tense thoughout. The patient was bathed in a cold clammy sweat.

Operation. July 4, 1917, 12:45 a.m., ether anæsthesia, iodine technique—enterorrhaphy, drainage—peritonitis, died.

The abdominal contents were reached through a left rectus incision. Upon opening the peritoneum, the intestines were seen to be covered with large flakes of fibrin, and they were intensely red and injected. The peritoneal cavity contained a large amount of a yellowish, foul-smelling material. A perforation, the size of a quarter of a dollar, was found in the descending colon, from which was escaping freely the intestinal contents. This was sutured and the peritoneal cavity flushed out with hot salt solution. Both the general and the pelvic peritoneum were drained with tube and gauze, and the wound closed down to the drains. The patient was returned to the ward in poor condition. He never reacted but gradually failed and died at 4:45 p.m., July 4, 1917. There was very little drainage from the tubes in the abdomen.

CASE 25. M. B., colored; male; age 30; laborer; of Baltimore; was admitted to the University Hospital at 3:15 p.m., October 11, 1918, for a stab wound of the abdomen. Fifteen minutes previously, while in a drunken brawl, he was stabbed twice in the abdomen, once in the right epigastrium and once at a lower level and to the left of the mid-line. From the latter wound, a piece of omentum was protruding. Both wounds were about an inch in length. The one on the right side was situated immediately over the liver and just below the costal margin. The second wound was located slightly below the umbilicus and about an inch to the left of the median line.

Operation, October 11, 1918, ether anæsthesia, iodine technique—exploratory laparotomy, drainage—cured.

The abdomen was entered through a right rectus incision. After opening the peritoneal cavity the omentum was withdrawn, ligated, and excised. With the exception of an incised wound in the anterior surface of the liver, inspection of the abdominal viscera was without result. A quantity of blood had escaped from this wound and, as it was still oozing, the gap was closed with a mattress suture of silk. All three peritoneal cavities were drained, the pelvic through a stab wound above the pubes. The original incision was then closed as far as the drainage permitted, and the patient returned to bed in fair condition. This man's convalescence was without incident. He was discharged November 18, 1918, cured.

CASE 26. G. U., white; male; tailor; age 41; of Baltimore; was admitted to the University Hospital, February 15, 1919, with the history of having assaulted his wife who in retaliation punctured his abdomen with a pair of scissors. The patient was a Lithuanian and could not speak English so no other history could be obtained.

Operation, February 15, 1919, ether anæsthesia, iodine technique—exploratory laparotomy, drainage—cured.

The wound was located in the right epigastrium a little to the right of the mid-line. As there was some doubt as to whether it had penetrated or not, the operative incision was made through the trauma. This revealed that the wound led into the peritoneal cavity. However, other than the cutting of a vessel in the omentum, which was still bleeding, no damage could be detected. The bleeding point in the omentum was tied. A hand in the pelvis detected a considerable collection of liquid blood. This was mopped out. Several drains were placed in the pelvic basin through a counter incision in the lower abdomen. Drainage of the upper abdomen was taken care of by appropriate measures, and the remainder of the abdominal incision closed. The man made an uneventful recovery. During his stay in the hospital he displayed an unbalanced mind, so he was transferred March 17, 1919, to an institution for the insane, but cured as far as the abdominal lesion was concerned.

CASE 27. B. N., white; male; sailor; age 27; of Germany; entered the University Hospital, July 29, 1919, for a stab wound of the left side. The wound was about 1 inch long and was situated in the left side of the abdomen on a level with the umbilicus. It had been sutured on the outside by a physician. The man was in considerable pain. The abdominal walls were hard and boardlike and tender to the touch.

GUNSHOT WOUNDS OF THE ABDOMEN

No.	Died	Recovered	Race	Age	Sex	Occupation	Operation—hours After Injury	Complications	Hollow Viscera Injured	Solid Viscera Injured	No Viscus Injured	Operation
1	Yes		C	30	F	Housewife	2	Pneumonia Toxæmia Exhaustion	Ileum, 12 holes	Mesenetry, 8 holes		Enterorrhaphy Resection of intestine, Murphy button, anastomosis, drainage
2		Yes	C	33	F	Laundress	1	Abscess left buttock	Ileum, 2 holes Urinary bladder 1			Enterorrhaphy, drainage of bladder by rubber tubage, drainage
3		Yes	C	35	M	Laborer	4			Liver, kidney		Laparotomy, drainage
4	Yes		C	24	M	Stevedore	2	Hæmorrhage Exhaustion	Jejunum, 5 holes Colon, 2 holes	Mesentery, 1		Enterorrhaphy, drainage
5		Yes	W	8	F	Schoolgirl	3			Liver		Exploratory laparotomy, drainage
6	Yes		W	26	M	Clerk	2	Wound in chest Hæmorrhage; exhaustion		Liver Diaphragm		Exploratory laparotomy, drainage
7		Yes	W	19	M	None	2	Pleurisy		Liver		Exploratory laparotomy, drainage
8		Yes	C	17	M	Laborer	3	Pneumonia	Bruising of small intestine and colon			Laparotomy, suture of contused walls, drainage
9	Yes		W	16	M	Painter	3	Exhaustion; hæmorrhage	Colon, 4 holes	Liver		Enterorrhaphy, drainage
10		Yes	C	29	M	Chauffeur	3		Contusion of stomach	Liver		Exploratory laparotomy, no drainage
11	Yes		C	21	F	Housewife	3	Hæmorrhage; shock	Ileum, 10 holes	Mesentery		Enterorrhaphy, drainage
12		Yes	W	19	M	ex-Marine	3	Pneumonia	Stomach, 2 holes	Liver, diaphragm		Gastrorrhaphy, suture of liver, drainage
13	Yes		W	71	M	Farmer	48	Peritonitis	Colon, 1 hole			Insertion of tube in colon, drainage
14	Yes		C	18	F	Housework	2	Collapse	Stomach, 2 holes	Liver		Gastrorrhaphy, drainage
15		Yes	C	32	M	Chauffeur	3		Stomach, 2 holes			Gastrorrhaphy, drainage
16		Yes	C	28	M	Laborer	1	Retention of drainage tube	Stomach, 2 holes			Gastrorrhaphy, drainage
17	Yes		C	34	M	Laborer	12	Hæmorrhage Peritonitis Gas infection	Small intestines, 5 holes, urinary bladder, 1 hole	Mesentery, 1 hole		Enterorrhaphy, suture of the urinary bladder drainage
18		Yes	W	29	M	Mechanic	4	Wound in chest		Liver		Exploratory laparotomy, drainage
19	Yes		C	25	M	Laborer	1	Peritonitis Hole in duodenum overlooked	Stomach, 1 hole Duodenum, 1 hole	Liver		Gastrorrhaphy, suture of liver, drainage
20	Yes		W	28	F	Housewife	2½	Peritonitis Hole in sigmoid overlooked	Sigmoid, 1 hole	Liver, pancreas, Lesser omentum		Exploratory laparotomy, drainage
21	Yes		C	33	M	Laborer	3	Peritonitis	Ileum, 7 holes Colon, 1 hole			Enterorrhaphy, drainage
22	Yes		W	44	M	Laborer	4	Hæmorrhage Collapse	Ileum, large hole	Mesentery		Resection of ileum, anastomosis by Murphy button, drainage
23	Yes		C	6	M	Schoolboy	2	Pneumonia; fæcal fistula Exhaustion Secondary hæmorrhage	Ileum, 1 hole Cæcum, 2 holes			Enterorrhaphy, drainage

STAB WOUNDS OF THE ABDOMEN

No.	Died	Recovered	Race	Age	Sex	Occupation	Operation after Injury	Complication	Hollow Viscera Injured	Solid Viscera Injured	No Viscus Injured	Operation
24	Yes		C	25	M		96 hrs.	Peritonitis	Colon			Enterorrhaphy, drainage
25		Yes	C	30	M	Laborer	½ hr.			Liver		Suture of liver, drainage
26		Yes	W	41	M	Tailor	Soon	Insanity		Omentum		Laparotomy, drainage
27		Yes	W	27	M	Sailor	Soon		Jejunum, 3 holes	Mesentery		Enterorrhaphy, wound closed
28		Yes	C	23	M	Laborer	1 hr.				Yes	Laparotomy, no drainage
29	Yes		W	6	M	Schoolboy	4 hrs.	Shock	Stomach	Spleen		Gastrorrhaphy, drainage
30		Yes	C	29	M	Laborer	2 hrs.	Slight suppuration, abdominal wall			Yes	Laparotomy, drainage
31		Yes	C	18	M	Messenger	2 hrs.			Omentum		Laparotomy, drainage

Operation, July 29, 1919, ether anæsthesia, iodine technique—enterorrhaphy—cured.

The incision was made through the left linea semilunaris. The jejunum was found to be punctured three times and the mesentery once. There was as a result, a hæmatoma of considerable extent between the layers of the mesentery. The wounds in the gut were closed with fine silk. The only drainage was rubber tissue to the bottom of the stab wound thus permitting a tight closure of the operative wound. After an uneventful course, the man was discharged August 9, 1919.

CASE 28. F. T., colored; male; laborer; age 23; of Baltimore; was admitted to the University Hospital, October 16, 1919, for a stab wound in the left, tenth costal interspace. It was about one-half inch long and deep. That it entered the peritoneal cavity was evidenced by the projecting of a piece of omentum through the wound. There were no signs of intestinal perforation or peritonitis. The man was in good condition, the pulse 110. The abdomen was not distended or dull. There were no signs of concealed hæmorrhage.

Operation, October 16, 1919, ether anæsthesia, iodine technique—exploratory laparotomy, no drainage—cured.

The wound was in the mid-axillary line and had been received early in the morning. He was on the operating table about an hour after the injury was incurred. The abdomen was entered by following the original wound. No visceral injury was found. The protruding omentum was cleansed and allowed to drop back into its natural habitat, and the wound was tightly closed. The postoperative course was smooth, by the 17th the patient's temperature was down to normal and he was suffering no pain or discomfort of any sort. He refused to remain in the hospital any longer, so was discharged October 20, 1919. At that time his general condition was very good.

CASE 29. W. O., white; male; schoolboy; age 6; was brought to the University Hospital, June 26, 1920, in a very serious condition. About 6 o'clock that afternoon the patient fell from a load of hay, the prongs of a pitchfork entering the left side of his chest and abdomen. The boy's respirations were hurried and his pulse fast. The abdomen was quite rigid. The whole left side of the chest was emphysematous. The temperature was 103.8, pulse 138.

Operation, June 26, 1920, ether anæsthesia, iodine technique—gastrorrhaphy—died.

The abdomen was entered by the lowermost prong which penetrated the soft tissues from behind the posterior axillary line and just beneath the costal margin. The abdominal cavity was entered through a left rectus incision. Inspection of the upper abdominal viscera showed the prongs to have entirely penetrated the spleen and to have entered the posterior wall of the stomach. The latter wound was sutured and capped with a piece of omentum. The lesser peritoneal cavity and splenic shelf were drained with one rubber tube and three cigarette wicks. The boy did not rally after the operation and died at 4:10 p.m., June 27, 1920.

CASE 30. F. D., colored; male; laborer; age 29, of Baltimore; was admitted to the University Hospital, at 1 a.m., August 29, 1920, suffering with a stab wound in the left side of the lower abdomen, incurred during an altercation with a colored woman 2 hours earlier. Although more than 10 feet of the small intestine were resting on the outside of the belly wall, the man was quiet and in no great pain. The gap in the abdominal wall was some 3 inches long and running along the outer border of the left rectus muscle, from without inward and slightly obliquely downward. The pulse was not greatly accelerated and the respiration was quiet. The man was in no shock and had apparently lost very little blood.

Operation, August 29, 1920, ether anæsthesia, iodine technique—exploratory laparotomy, drainage—cure.

While the skin was being cleansed the protruding intestines were protected with a sterile towel. Before inspecting them for possible perforation or other damage they were washed off with normal salt solution. The toilet having been completed the abdominal wound was enlarged at both its upper

and lower extremities and the intestine then inspected carefully for trauma. As none was found the gut was returned to the abdominal cavity. One rubber tube and two cigarette drains were placed in the pelvis, two cigarette drains in the flanks and one in the soft tissues. The wound was then closed down to the drains, all of which emerged at the lower angle. The man was returned to bed in fair condition. With the exception of a slight superficial suppuration, the patient made an uninterrupted recovery and was discharged from the hospital, September 25, 1920, with the wound entirely healed, save epithelization of the drainage site which was however closed in up to the skin. He gave a 100 per cent Wassermann.

CASE 31. T. H., colored; male; delivery boy; age 18; of Baltimore; was admitted to the University Hospital August 14, 1921, for a stab wound through the lower part of the left rectus abdominis muscle. The wound was located 2 inches below the umbilicus and in the mid-axillary line. There was no doubt that it had penetrated, as witnessed by the protrusion of 2 inches of the omentum. The belly wall was very rigid, but the pulse was good. The wound was inflicted about 2 hours before admission.

Operation, August 14, 1921, ether anæsthesia, iodine technique—exploratory laparotomy, drainage —cured.

The abdominal contents were explored through a lower, left rectus incision. Investigation of the entire intestinal tract was without result. Several bleeding points in the omentum were ligated. The section of omentum exposed to contact with the wound was resected and withdrawn through the knife tract. The stump was washed off with alcohol and allowed to drop back into the peritoneal cavity. One cigarette tuck and one tube were placed in the pelvis and one cigarette wick to the left kidney shelf. The abdominal wall was closed with the exception of the point of emergence of the drains. The boy was returned to the ward in good condition. With the exception of a moderate rise in temperature and pulse rate the patient made an uneventful recovery and was discharged September 21, 1921, cured.

These cases, 31 in number, were observed during the period from January 1, 1917 to September 1, 1921. Sixteen recovered, 15 died; 25 were males, 6 females; 19 were colored, 12 white; 23 were gunshot wounds, 8 stab. Of the stab wounds, 2 died, 6 recovered; of the gunshot 13 died, 10 recovered. Of the gunshot wounds, the hollow viscera were perforated 16 times, with four recoveries, 3 of which were of the stomach. Of the perforations below the pylorus, 11 in number, but 1 recovered. Of the 10 cases of gunshot wounds that got well 2 involved the stomach, 1 the stomach and liver, 1 the jejunum and urinary bladder, 3 the liver, 1 the liver and kidney, 1 a bruise of the small intestine and colon and 1 a contusion of the stomach. There is a possibility that five of the last six would have recovered operation or no operation. Until some method is devised, however, whereby the damage done can be accurately ascertained, direct inspection of the abdominal organs offers the best hope of cure to these patients, as with the means at hand nobody can foretell before operation the lesion. In 2 instances perforations in the hollow viscera were overlooked and these patients promptly succumbed to peritonitis. This has been the invariable rule with this type of cases in our clinic. Never have I seen a case of overlooked perforating gunshot or stab wound of a hollow viscus recover; that such a fortunate outcome may occur I am not prepared to contradict, but it has not been my good fortune to witness such a happy turn of events. Twelve of the deaths in the gunshot series occurred in cases in which the hollow viscera were perforated. Only 1 of these occurred in 4 perforating wounds of the stomach, leaving 11 deaths assignable to perforations in the small or large intestine, a mortality of 91.66⅔ per cent. Though the series is small and the mortality high, this is no brief against operation, as a possible 8 and a fraction recoveries in every 100 cases is far better than 100 deaths. The stomach series is a little more cheering in as much as there is a percentage of 75 per cent cures.

All of the deaths except two from the oversight of holes in the gut, were due to unavoidable causes, for the most part collapse from internal hæmorrhage. One is forcibly struck by the number of these accidents complicated by lung affections. In 4 instances the injury was followed by pneumonia, in 1 by pleurisy. In 1 case the death was attributed to gas bacillus infection. One patient was received 96 hours after the accident, 1, 48 hours, 1, 12. All of them died. All the rest were admitted from ½ to 4 hours after the receipt of the trauma.

Of the stab wounds three perforated the hollow viscera. Only one recovered, 33⅓ per cent. Case 24 was without operative treatment for 96 hours and was in poor condition.

He was operated on only with the idea of giving him a chance for recovery. In Case 30 the patient came into the hospital supporting with his bare hands 10 feet or more of small intestine coiled up on the outside of his abdomen. Fortunately the bowel was not injured and the man eventually made a good recovery. Though the result in the above series is not overly gratifying, it is no brief against the use of exploratory laparotomy.

None of the cases died in which no damage or but little damage was detected and two did succumb in which a hole in the bowel was overlooked. Although Captain Basil Hughes, R.A.M.C.,[1] reports 16 soldiers with such injuries who were not operated upon with 11 sent to the base, 3 of whom developed fæcal fistula, and 5 of whom passed blood per rectum, civil practitioners are not yet prepared to adopt non-operative measures when these patients are received sufficiently early after the receipt of the injury, until a better method of handling these cases has been proposed, tried, and proven.

[1] Brit. J. Surg., 1916-17, iv, 758-766.

THE REMAINING BREAST AFTER RADICAL REMOVAL OF THE OPPOSITE SIDE FOR CARCINOMA[1]

By HUGH H. TROUT, M.D., F.A.C.S., Roanoke, Virginia
Surgeon-in-Chief, Jefferson Hospital

IN a review of one hundred and seventy-three operations for carcinoma of the breast, necessarily many interesting and some instructive facts have been ascertained. One of the most useful results of such an analysis, I believe will usually be found to be the information so acquired, is so disappointing regarding his permanent cures, as to lessen the conceit of the average surgeon.

I will not present even a résumé of the results of our studies in this series further than to discuss briefly the future of the remaining breast, giving especially consideration to that rather small group of women coming within the childbearing period, and having cancer of the breast. It is more than likely such a consideration would not have occurred to us, had we not happened to have had visits from two such patients within a very short period of time. Both of these visits being so close together, and presenting such an unusual condition of affairs, naturally focused our attention on the necessity of reviewing all our cancer of the breast cases with the object of ascertaining what effect pregnancy had on the remaining breast after the patient had already exhibited, to say the least, a "tendency to cancer," by having been the host of such a disease on a previous occasion.

With such an object in view, we ascertained there were only thirty-one of these cases in our series under the age of 40 years. We were successful in obtaining information concerning twenty-nine of this thirty-one, and, of this number, only two had become pregnant, and, the most important point of this study, hinges on the fact of both of these cases having developed carcinoma in the remaining breast.

Very briefly the essential facts of these two cases are as follows:

Case 1, age 34, first admitted April 16, 1912, with carcinoma about 4 centimeters in diameter in upper outer quadrant of left breast. Known duration of tumor about 8 months. Mother of three children—12, 8 and 4 years. Nursed all children without trouble and with sufficient milk in both breasts. Tissue and glands removed from axilla and from under the falciform or triangular ligament did not show any signs of malignant invasion. No glands were palpated in supraclavicular region. Sections of tumor showed carcinoma. No pain and no signs of malignant involvement, or of mastitis in the opposite breast were present.

This patient remained free of all symptoms until about 1 month before her return to hospital on May 18, 1916, practically 4 years interval, at which time she noticed her right breast contained a tumor which could be easily palpated, and, this in spite of the breast being considerably larger than normal, due to the existence of a 7 months' pregnancy. During the month in which patient watched the growth of the tumor, it increased very rapidly, and, when examined, suggested a zone of inflammatory infiltration for several inches around the tumor. Another radical operation was done, revealing a carcinoma of the upper, outer quadrant without involvement of the glands of the axilla, and having no attachment to the chest wall.

Four days after operation, while we were debating what to do concerning the pregnancy, the patient kindly solved the situation for us by expelling a dead fœtus. This patient was examined in September, 1921, and is apparently well. She has had no further pregnancies, having been instructed to use all possible precautions to prevent them. Sections of this tumor were sent to Dr. W. H. Welsh, and Dr. J. C. Bloodgood, both of whom also gave the diagnosis of definite malignancy.

Case 2. Age 32, first admitted June 14, 1911, and differs only from Case 1 in the following respects: Mother of one child of 12 years. After an interval of about 6 years, patient returned on June 6, 1917, being about 8 months pregnant, and with a history of having noticed a lump in the upper, outer quadrant of the right and remaining breast about the sixth month of her pregnancy. This growth must have increased very rapidly in size for, when she reported to us, not only was the breast involved, but the patient presented many signs and symptoms of a general carcinomatosis. The patient stated when she first noticed the growth that it was not larger than a "small marble," and, as far as could be ascertained from her history, she did not have any symptoms of chest or abdominal involvement until about 1 month before her return to the hospital. No operation was advised, but she died on June 18, 1916. The family refused to allow an autopsy,

[1] Read before the Southern Surgical Association, Pinehurst, December, 1921.

so all the information we could obtain was through an abdominal incision which the undertaker was persuaded was necessary to embalm the body properly. This showed a general involvement of the abdominal viscera, being most extensive in the liver. The fœtal heart sounds ceased 4 days before the mother's death. Apparently there was no involvement of the uterus. No tissue was obtained at the autopsy for microscopic sections. Due to the numerous classifications at present employed in different clinics we thought best simply to use the term carcinoma and not to attempt any differentiation of type.

A review of literature shows many authors expressing the belief that there is some association between mammary changes due to pregnancy and carcinoma of the breast. Such a hypothesis is most natural and, especially so, when one recalls the histological anatomy of the breast, with its numerous lobes, lobules, and large number of acini lined with epithelium, and richly supplied with capillaries. This complex picture is made even more confusing by the marked changes, especially in the epithelium, incident to the preparation for lactation. In a slight deviation from normal in such a complicated transformation, one can find ready application for any of the usually accepted theories concerning the etiology of carcinoma.

It is more than probable there are additional factors other than the normal changes in the breast incident to a pregnancy, existing, and of these factors none holds a higher place in the realm of present day theory than the rôle played by any chronic irritation. We all recall a few years ago Dr. Bloodgood sending to numerous pathologists slides of questionable diagnosis between chronic mastitis and malignancy. The microscopical diagnoses received after such an extensive study from so many different sources, varied so greatly as to convince many surgeons that there must be a close association between these two conditions.

In considering the causative factors of mastitis, certainly pregnancy ranks high. In a recent reply from Dr. Walter E. Sistrunk, of the Mayo Clinic, he states: "For sometime I have felt that when a patient has carcinoma in one breast and a definite mastitis in the other, both breasts should be removed, on account of the fact that I have, on several occasions, seen a carcinoma later develop in the breast where the mastitis was present. This may be done at one operation, or as a second operation according to the difficulty of the first operation."

As a study of literature did not reveal a report of any effort having been made to determine the future of the remaining breast in the advent of a pregnancy in this class of case, we wrote to a number of our surgical friends and an analysis of 62 replies received showed very clearly no such postoperative "follow up" has been made. Forty-six out of this number volunteer the information of having noticed that pregnancy apparently stimulated cancer to develop more rapidly no matter where the growth might be located.

In this series of replies there were reported 17 cases of carcinoma of the breast associated with a pregnancy. All these cases were seen late in the disease and all went to a rapid and fatal termination. These cases had not been preceded by an operation and as this information was volunteered, there was probably numerous other cases not mentioned.

One very interesting and the most important point ascertained from these replies is found in the fact of there having been only 15 instances in which pregnancy is known to have occurred after removal of a breast for carcinoma. Of this number 13, practically 87 per cent, developed carcinoma in the remaining breast, 12 of whom died very promptly. The interval period between operations and recurrences associated with pregnancy varied from 2 to 10 years.

Dr. Irvin Abell states that he has had only one case to become pregnant "and she had an induced abortion at the end of the third month—this abortion was done in the fourth year following operation, now 2 years ago, and the patient remains well." This case was not listed because it is impossible to estimate what would have happened if the pregnancy had been allowed to continue. Certainly the abortion was induced because of fears of the damage resulting from continuation of the pregnancy.

We did not include in this estimate a case reported by R. L. Payne, of a woman

having had a radical breast amputation on the right side at the age of 41. "At the age of 45 her menstrual flow stopped suddenly," and she reported back to Dr. Payne with symptoms suggesting pregnancy and a definite lactation in the left and remaining breast. There was no pregnancy present, but Payne expressed the opinion that "the lactation had evidently been incited by the fear of pregnancy." Twelve months after lactation ceased Payne did a "radical amputation of the breast which showed in the laboratory infiltrating adenocarcinoma just below the nipple in the upper quadrant." This last operation was in 1910 and the patient is still living."

Due to the numerous classifications at present employed in different clinics, we thought best simply to use the term carcinoma and not attempt any differentiation in type.

Fred L. Hoffman, LL.D., etc. statistician, Prudential Insurance Company of America, was unable to give any data on the occurrence of cancer in the remaining breast either with or without the existence of pregnancy. No further information as regards such percentages can be obtained from literature or from replies received from these 62 surgeons, though, as we all surmise, recurrences are apparently more apt to occur in younger people than those of the sixth or seventh decade.

In our 27 cases under 40 years of age who did not become pregnant, there was not a case of recurrence of the cancer in the remaining breast; although the recurrences elsewhere in the body where much higher in this group than in the rest of the series, all of whom were over 40 years of age. Of this group over 40 years of age, we obtained definite information from 106 — only 9 of whom, or less than 10 per cent, developed cancer in the remaining breast, and this in spite of the fact of our recurrences being as high as most of the recently published reports.

In the reply received from James F. Mitchell he reports a case having a 13-year interval, and then developing carcinoma in the other breast, but not associated with a pregnancy.

In a review of 218 cases of carcinoma of the breast from Rochester, Minnesota, 10 per cent more of those over 50 years were alive from 5 to 8 years after operation than of those under 50 years, suggesting there might be some ground for the rather prevalent opinion "the younger the patient the more active the malignancy."

If these observations and deductions are correct, we believe that surgeons should warn their patients, who are in the childbearing period and from whom a carcinoma of the breast has been removed, not to become pregnant for fear of serious trouble in the remaining breast.

NOTE.—Since writing the above article my attention has been called to a most interesting paper by Dr. Alson R. Kilgore, published in the *Journal of the American Medical Association*, August, 1921, "The Incidence of Cancer in the Second Breast." Dr. Kilgore does not analyze his cases in relation to subsequent pregnancies, but states that if the patient survives five years she is "from three to four times more likely to develop cancer in the second breast than a normal woman of the same age in either of her two breasts." To anyone interested in the subject of cancer of the breast, Dr. Kilgore's work will be of great interest.

HYPEREMESIS GRAVIDARUM[1]

By CHARLES E. PADDOCK, M.D., F.A.C.S., Chicago

THE use of the duodenal tube for diagnostic purposes and treatment of gastroduodenal disorders is familiar to most of us, but, as far as I know, the use of the tube in the treatment of hyperemesis gravidarum, excessive vomiting of pregnancy, is not usual. I can find no report of cases of hyperemesis gravidarum having been so treated.

My attention was directed to its use in such cases by Dr. Milton Portis some two years ago, and it was used at that time with marked success as will be seen in Case 1. Since then I have had but three similar cases which could not be corrected by the usual treatment for excessive vomiting of pregnancy. Two of these I successfully treated by the use of the tube but the third patient refused to be so treated and continued to pull out the tube. Failing in her case the uterus was emptied.

It is not the intention of this paper to enter into the discussion of the etiology of hyperemesis gravidarum, numerous theories have been advanced to explain its cause and the medical literature is full of articles written upon this subject. Theories are not facts and this is evident when we read the numerous theories which are assigned for the cause of hyperemesis gravidarum. No sooner will one cause be given than it will be replaced with another. I doubt that we are any nearer a solution of the etiology of this distressing condition than we were 10 years ago. Suffice it to say we have in hyperemesis gravidarum a condition which at times baffles the most skilled clinician and occasionally leads to the death of the patient.

Hyperemesis gravidarum usually occurs early in pregnancy, after the seventh week, and while we often find it occurring in the latter weeks of pregnancy, it has occurred to me that it is not of a different etiological factor from that occurring later.

The late vomiting seems to belong to that class of toxæmias which are considered as pre-eclamptic; and as it is one of the multiple manifestations of the toxæmias, it not only calls for attention from the obstetrician but from the gynecologist, from the ophthalmologist, and from the internist. The physiochemist and the neurologist are often consulted. A recognition of this fact by any physician having a severe case of vomiting in his care may be of vital interest to his patient, as well as a great source of satisfaction to himself.

Nausea and vomiting in early pregnancy is frequent, statistics varying from 30 to 60 per cent, and the degree varies from a mild to a very severe form. There is no way to determine beforehand whether or not a patient will suffer from this distressed condition. The fact that she has been exempt from it in a previous pregnancy does not necessarily mean that she will be in a succeeding one. I have a patient at present who is in her third pregnancy and is suffering from very severe nausea and vomiting. Preceding pregnancies have been perfectly free from either, although there are no pathological lesions which can be found to cause it.

Vomiting of early pregnancy may be divided, for convenience, into three stages:

First, there is the disagreeable nausea with slight vomiting of mucus which comes on soon after the first missed menstrual period. The patient may crave food which usually is indigestible and unpalatable, rejecting other foods and able to keep down the former.

The second stage is ushered in with constant nausea, all food and liquids being rejected and soon the vomitus contains bile and blood. The urine becomes scanty and albumin and casts appear. The skin becomes dry and hot, although there is little if any rise of temperature. Diacetic acid and acetone are present. This condition goes on for a week to two weeks, the patient gradually becoming dehydrated, the symptoms increasingly severe.

The third stage is ushered in with marked acidosis, perhaps less vomiting and more or

[1] Read before the Chicago Gynecological Society, November 18, 1921. (For discussion, see p. 689.)

less delirium. Scanty urine with an increase of casts, blood, and albumin, a thready, weak pulse and a slight rise of temperature. Frequently at this time all vomiting ceases and the patient seems on a fair way to recovery, food is taken and apparently the organs are functioning normally, but the damage already done to the liver and kidneys is too great and the patient dies. The postmortem findings are usually those of acute yellow atrophy.

That we have no specific treatment for this excessive vomiting is evidenced by the multiplicity of drugs which have been, from time to time, held up to the profession as specific, only to be cast aside later as of very doubtful value. As specifics we have been given ingluvin, the blood of a puerperal woman, or a placental extract, thyroid extract, and corpus luteum; we have also been deluged with literature upon this subject, not only from proprietary drug houses but from men who stand high in our profession. Please do not misunderstand me; I do not wish to say all of these agents are not useful but that they are not specific I contend.

It is not so very long since we were advised to use extract of corpus luteum, by mouth, then to use it intramuscularly, and now it must be given intravenously, the latter said to be the only way to get results. But why such great claims only a short time ago when given by mouth? I am always very skeptical when shown statistics furnished because of the use of "specifics."

Hyperemesis gravidarum in early pregnancy is rare; vomiting in early pregnancy is not so rare, and one must learn to differentiate the two. This is why we have so many "specifics." The physic-element plays a very important part in the cure of vomiting of pregnancy. This fact, however, must not permit us to forget the possibility that a so-called physiological vomiting of pregnancy may not become, through neglect in treatment, a pathological one,—that is a hyperemesis. I do not like the term "physiological nausea and vomiting," and the sooner our textbooks omit that term the better.

Every case of nausea with vomiting in pregnancy should be considered as an abnormal condition demanding the attention of the physician. How often the patient is told that vomiting must be expected and that at a certain time in the pregnancy it will stop. It is just such advice as this that places the life of the woman in jeopardy. But recently I saw a case of vomiting carried to the limit, the attending physician claiming that he had never had a case that failed to recover. This one died.

To terminate the pregnancy is the last resort in the treatment of hyperemesis gravidarum, and unless the vomiting has been allowed to go too far beyond what we may call the danger line, the result of such treatment has been miraculous. From days and weeks of nausea and vomiting the patient's recovery is like magic. No sooner is the uterus emptied of the ovum than all nausea and vomiting cease. The product of conception, however, is sacrificed and it is because of this fact that I wish to report results by another treatment which will do away with the termination of the pregnancy in many cases.

CASE 1. Mrs. W., age 30. Trained nurse before marriage. Small bones. Slight build; weight 95 pounds, when well. June 5, 1918, entered St. Luke's Hospital because of severe vomiting, about 3 months' pregnant. Was in very poor condition physically vomiting almost continuously; very little food or water for 2 weeks previous to entering hospital. Tissues dehydrated and symptoms of starvation. Usual remedies used with poor result. Urine scanty, marked acidosis, hyaline casts. The duodenal tube was passed, and after 6 hours was found to be in the duodenum. Sedatives and fluids, peptonized milk and cream were given in small quantities. Temperature and pulse remained normal. Nausea and distress continued. For some reason not explained in history sheet tube removed on the twenty-fourth and passed again on the thirty-first. After this the patient made a satisfactory recovery. Due to a justominor pelvis, a cæsarean operation was performed on December 20, 1918.

CASE 2. Mrs. McKee, age 33, married 10 years. One child 7 years of age. Last menstruation about June 5. Menstrual history normal, 28 day type. Has "hay fever" every summer. Otherwise general health good. Saw her at home about August 1, was then about 3 months pregnant. Has been unable to keep liquids or food on stomach for 3 weeks. Patient very much depressed and had evidently lost much in weight. Her husband being a physician had used everything known in line of treatment. Rectal feeding, with all fluids restricted by mouth, had been tried with no success. Patient's skin dry

and tissues dehydrated. Patient removed to St. Luke's Hospital and on August 15 the Rehfus duodenal tube inserted. The daily report taken from the history sheet is as follows:

August 14, 1921. Duodenal tube passed. Feeding commenced. Tube in place in 6 hours. Depeptonized milk, water, total 24 hours, milk 83 ounces retained, no attempt at vomiting—slight nausea.

August 17, 1921. Patient doing well. No emesis, Fluids—corpus luteum intravenously.

August 19, 1921. Subjective symptoms much improved. Liquids—no emesis. No distress from tube.

August 20, 1921. An attack of hay fever lasting through the day (evidently an acute coryza).

August 21, 1921. Tube removed after 7 days, patient appearing like a different person.

August 23, 1921. Subjective symptoms very good; taking solid food.

August 25, 1921. Patient not so well. Complains of waves of nausea—emesis late in the day.

August 27, 1921. Emesis profuse. Restless. Rectal feeding. Very much depressed.

August 29, 1921. No improvement. Tube passed. Feeding commenced after six hours.

August 31, 1921. Subjective condition much improved. No distress from tube.

September 1, 1921. Complains of distress and some pain over whole abdomen. Milk of magnesia in small quantities, much relief. Bowels moving freely.

September 3, 1921. Patient removed to her home. An apparent gain in weight. Tube not removed. Feeding by tube continued for 1 week longer and tube removed.

Patient passed out of my hands but I understand made a fine recovery. I saw her 10 days after she left the hospital and then she was up and around. Had much improved in weight and general condition good.

Laboratory report. The blood chemistry examinations which were made two or three times by Dr. Williams gave us no information as to the severity of the case.

The urine always contained traces of albumin, high specific gravity, and hyaline and granular casts. There was no tenderness over the liver, but the patient gave the picture of one very sick.

This case was one upon which I would formerly not have hesitated to interrupt the pregnancy. In this case I did not at first have the co-operation of the patient, and I am sure the husband was impatient at my optimism for the success of the treatment. Much depends upon the hearty co-operation of the patient.

Recently I had a similar case but, if anything, much nearer the danger line. Starvation symptoms were much in evidence. The tube was passed but the patient would repeatedly remove it. I pleaded with her because of my fear that the case had progressed too far. It looked like a very poor risk for an abortion. She being a devout Roman Catholic gave me hope but I was compelled to empty the uterus. Like magic this patient recovered.

CASE 2. Mrs. M., primipara, married 4 years. In consultation with Dr. A. W. Woods. Menstrual history normal—28 day type. General health good, always good. No extensive illness. No operations. Last menstruation March 1, 1921. I saw this patient in consultation with Dr. Woods June 1. She was pregnant about 3 months. Vomiting was severe. Patient very much emaciated. Marked acidosis; urine scanty. High specific gravity, with albumin and hyaline casts. Occasional blood in the vomitus. Patient appeared very sick. Skin dry. Pulse 100-110. Blood pressure, systolic 130, diastolic 90.

As Dr. Woods was to leave the city the next morning, he had decided to empty the uterus that day. At his request I took charge of the case. The tube was passed immediately. The tube entered the duodenum in 4 hours and feeding commenced. The success in this case was remarkable. In one week the tube was removed and the next day she was taken home. No study of the chemistry of the blood had been made in this case, nor of the nitrogen partition of the urine.

Here then are three cases which ordinarily would have been terminated by abortion. They were all sick. The bedside picture showed them to be desperately so, emaciated, listless, begging to be relieved of their distress, and the clinical findings showed beginning destructive organic changes. These patients are alive, two of them have had their babies, and the other one is about at term.

As far as I know this is the first report of a case of hyperemesis gravidarum, or excessive vomiting of pregnancy, which has been treated by duodenal feeding, and while three cases are not enough to prove that all cases of hyperemesis gravidarum may result as successfully I am satisfied that the tube has its place in the treatment.

CHILDBIRTH

Primitive versus Modern[1]

By C. H. DAVIS, M.D., F.A.C.S., Milwaukee, Wisconsin

THE geological records of prehistoric man give some idea as to how he lived. We know that the sex instinct must have played an important part in his struggle for existence. To what extent the early woman of our race was treated differently from the female of the higher mammals, we can only guess. Probably childbirth for her was not dissimilar to that of the higher apes of today. But with no written word from neolithic man, we must turn to the primitive peoples of our own age for study of labor among primitive races.

America, with its Indians, negroes, frontier and growing cities with emigrants from all countries, gave obstetricians of the past century the unusual opportunity of being able to study the primitive in obstetric art as well as the most modern. Therefore, it is only natural that a St. Louis obstetrician, George J. Englemann, should have written his very interesting and instructive book on *Labor Among Primitive Peoples*. To Dr. Englemann's book we are indebted for descriptive drawings and much of our information regarding primitive childbirth.

Empirical obstetrics dates from the early centuries of man's existence, and is the practice of all primitive peoples in all ages. During the early centuries before races intermarried, pregnancy and childbirth was a more purely physiological process than it is today, and doubtless it caused woman very little discomfort. Woman probably gave birth unaided and there was little regard for either fœtal or maternal life in event of complications. Natural law prevailed and, therefore, only the fittest of each generation could long survive. Large families were an economic asset and early man valued his wives, partially at least, according to their fertility. This was true in early Biblical times.

At the dawn of history intuitive obstetrical practices were probably as well developed as was possible with the complete ignorance of anatomy and physiology. Sometime in the past ages the older women who had borne children began to assist the younger during the ordeal of childbirth. Some of these must have possessed superior skill and they in turn instructed others in the use of varying postures, massage, and nauseating drinks. Midwives, empirically educated, were found in all of the old civilizations and semi-civilizations.

Judging from the earliest written records, maternity has appealed to the sympathies as well as the most sacred instincts of all peoples. It is undoubtedly true, as Englemann suggests, that the obstetric practice of a tribe or nation is indicative of its civilization, culture, and morals. With the development of his intelligence, man developed a religious instinct, and this in turn created a new attitude toward the relation of man and woman. For in *Genesis*, 2:24, we read: "Therefore shall a man leave his father and his mother, and shall cleave unto his wife and they shall be one flesh."

Empirically trained midwives had a well-recognized position among the Israelites at the time of the exile into Egypt, for in *Exodus*, chapter 1, verses 15 and 16, we read: "And the King of Egypt spake to the Hebrew midwives, of which the name of one was Shiprath, and the other was Puah: And he said, 'when ye do the office of a midwife to the Hebrew women, and see them upon the stools; if it be a son, then ye shall kill him: but if it be a daughter then she shall live.'" This also indicates an early use of the obstetrical stool or chair which was an outgrowth of sitting on another person's lap during childbirth, referred to in *Genesis*, chapter 30, verse 3, where Rachel says: "and she shall bear upon my knees."

Among semi-civilized peoples the priests were presumed to be the most intelligent of all men. It is, therefore, natural that when her empirical methods failed, the midwife

[1] Read before the Chicago Gynecological Society, November 18, 1921. (For discussion, see p. 686.)

should turn to them for assistance. At first it is probable that the priesthood gave only spiritual aid in the hope of driving out the evil spirits which interfered with the escape of a child from its mother's womb. However, we know that in Egypt and Greece they gave mechanical aid. At a very early date cæsarean section is believed to have been performed by priests. The first crude instruments for the mechanical removal of a dead fœtus were probably designed and used by them.

Hippocrates (400 B.C.), the father of western medicine, gathered and to large degree disseminated the obstetrical knowledge of his time. He established medicine as apart from religion, and the physican became the one skilled in operations to remove the fœtus which could not be born. During the preanatomic epoch which followed Hippocrates, obstetric practice remained in the hands of empirically trained midwives. Cephalic presentations alone were hopeful. The obstetric chair was in common use and carried by the midwife from house to house. Destructive obstetrical operations were taught as a branch of surgery, but the physician was never called until after the death of the child.

We are told that the obstetrical teachings of Hippocrates became known to the Arabs and were carried by them to the East and West. His teachings penetrated to Rome shortly before the Christian era. Celsus (30 B.C. to 14 A.D.) and Soranus (under Trojan, 98 to 112 A.D.) made real contributions to obstetrics. Hippocrates' teachings may have reached India and the Orient, but it is equally probable that they developed similar ideas more or less independently. The medical men in all countries probably started with the religious laws and obstetric precepts of the priesthood, and century by century as they gained some knowledge of the gross palpable anatomy of the woman, tried to improve the operative measures. Soranus was the first, so far as we know, to teach podalic version before the death of the child; but when this was impossible, he, like the others, resorted to embryotomy. "The teachings of Soranus mark the highest development of the obstetric art in the ancient civilization of the west; fathered by Hippocrates, fostered by Celsus, it was perfected by Soranus, with whom independent original work and progress cease for fifteen centuries." (Englemann.)

There has been more progress in obstetrical development during the past century than during the many thousands of years since the first of the paleolithic men roamed the European and Asiatic wilds. That knowledge of this important function of woman should have developed so slowly seems strange until we recall that: "It was woman who gave aid to her sister in childbirth; the obstetric art was in the hands of women—women of low caste; it was looked upon as woman's work, and progress was thus impeded, if not impossible. While the aid of priests, or men possessed of mystic powers, was sought for in difficult cases, they were at other times carefully excluded from the lying-in room, and thus prevented from gathering the experience necessary for progressive innovation. It was eminently the sphere of women, and so considered until the era of modern scientific medicine. We need but recall the fate of Dr. Wertt, of Hamburg, who in 1522 put on the dress of a woman to attend and study a case of labor, and was burned alive for his pains; or that of Dr. Willughby, one hundred years later, who assisted his daughter, a midwife, in a difficult labor, and was obliged to crawl into the darkened room on hands and knees. The title of *meauti*—man-grandmother—was given by the Greeks in the time of Hippocrates (400 B.C.) to men called in difficult cases; this spirit pervaded up to the scientific period, as indicated by the appellation of 'man-midwife' given to Chamberlain, the inventor of the forceps, in the middle of the seventeenth century; and the adherence, even now, of the mass of the people to the midwife of the older countries, show how deep seated this feeling is. During that entire era of empiricism, progress was possible only as far as the eye could reach; the important parts were concealed, the mechanism only to a slight degree exposed. Without means of penetrating or bringing to view the mystic process, actual progress was out of the question, and did not take place until the scalpel

opened the way and medical men entered upon the art in the middle of the sixteenth century." (Englemann, *History of Obstetrics.*)

MODERN

The rediscovery of internal podalic version by Paré in 1550 was the first of the great steps in the development of scientific procedures in obstetrical practice. Or should we say the application of scientific principles to the art of obstetrics? The development of the obstetrical forceps beginning with Chamberlain's secret use in 1647; the detailed study of normal and abnormal labor; the limitation of craniotomy due to the perfection of delivery by version and forceps, and the reappearance of the induction of premature labor; the discovery of the cause and nature of childbed fever by Oliver Wendell Holmes (1843) and Semmelweiss (1847); the introduction of anæsthesia by Simpson in 1847; the description of combined version by Wright, of Cincinnati, and a little later by Braxton Hicks, of London, in 1854; the application of antiseptic methods to delivery-room technique in 1870 by Stadfeldt, of Copenhagen; and the performance of conservative cæsarean section by Sanger in 1884 are the great landmarks in the growth of present obstetrical methods.

Mauriceau, who lived in Paris at the end of the seventeenth century is said to be the first physician who devoted himself exclusively to the study and practice of obstetrics. Ambroise Paré, a century earlier, had been noted as a surgeon as well as an accoucheur. "It was not, however, until the middle of the eighteenth century that obstetrics was divorced from its intimate connection with surgery, and also disencumbered from the trammels of ignorance, superstition, and empiricism, which had so greatly retarded its progress." (Hodge.) Smellie in England and M. Levret in France greatly improved the obstetric forceps and their teachings lead to a rapid increase in the number of practitioners of this branch of medicine in their respective countries.

DEVELOPMENT IN AMERICA

Among the early American obstetricians was James Lloyd a graduate of Harvard University and a student of Smellie's, who began practice in Boston in 1752. Thomas Bond and his brother Phineas Bond were early obstetricians of Philadelphia. William Shippen, Jr., returned to Philadelphia in the spring of 1762, after studying with William Hunter and McKinzie in London, and in the fall of the same year began a course of lectures upon anatomy, surgery, and midwifery, thus laying the foundation for the first regular course of medical instruction in the United States. He and John Morgan founded the Medical College of Philadelphia, now the University of Pennsylvania. John V. B. Tennant was the first professor of obstetrics in Kings College (now Columbia), the medical department of which was started in 1767. Harvard University appears not to have had a department of obstetrics until 1815 when Walter Channing was appointed lecturer upon obstetrics and medical jurisprudence. He was instrumental in America for the early popularization of anæsthesia during labor, and in 1848 wrote a monograph on this subject.

During the nineteenth century medical schools multiplied in every part of the United States. In all of them some obstetrics was taught. To William P. Dewees is given the credit of first attempting a broader course of training in obstetrics, when in 1797 he gave private lectures in Philadelphia. In 1808, Wistar was appointed professor of anatomy and midwifery in the University of Pennsylvania. It was due to his suggestion that in 1810 Thomas C. James was appointed professor of obstetrics and the diseases of women and children, but the course was not required for graduation until 1813 when the board of trustees passed the following resolution: "Resolved, That hereafter the professor of midwifery shall be a member of the medical faculty, and shall have all the powers, authority, privileges belonging to a professorship in said faculty; and that no person shall be admitted hereafter as a candidate for the degree of doctor of medicine in this university, unless he shall have regularly attended the lectures of the said professor for two years; provided, etc." To Dr. James, therefore, goes the honor of giving the first regularly recognized course of obstetrics in the United States.

Samuel Bard, of New York, published the first American work on midwifery in 1808. The previous year Dewees had secured the republication in the United States of Heath's translation of Baudelocque. Following this, various of the European works had American editions. Bard's fourth edition was enlarged for the use of medical students in 1817; and Dewees published his splendid system of midwifery in 1825. The next American text book was *The Philadelphia Practice of Midwifery* by Charles D. Meigs, published in 1838. Three years later he became professor of obstetrics in Jefferson Medical College. Henry Miller, professor of obstetrics in the University of Louisville in 1858, published the first work on midwifery issued from the middle west. This was followed by Gunning S. Bedford's *System of Obstetrics*. He was then professor of midwifery in the University of New York. But to Hugh L. Hodge in 1866 goes the honor of producing the first well illustrated obstetrics with one hundred and ten wood cuts. This work appeared at the end of his teaching career and after he had become emeritus professor of obstetrics and the diseases of women and children at the University of Pennsylvania. Dewees' second edition has only eighteen cuts at the end of the text. William T. Lusks' *Midwifery* published in 1881 and Barton Cooke Hirst's *American System of Obstetrics* published in 1888, are among the best known of the early works of the passing generation of obstetricians. The later works of Hirst, Webster, Cragin, Edgar, Williams, DeLee, and others are all well known to the more recent students. The famous obstetricians already mentioned and their co-workers developed the specialty of obstetrics to a height in this country which is not surpassed elsewhere. Our medical publications of the past century are rich in their contributions, but today, paradoxical as it may seem, the United States, of the more civilized countries, has the worst as well as the best in obstetrical practice. At least the investigation of Dr. Meigs of the Children's Bureau indicates that of sixteen civilized countries the statistics of which have been studied we stand fourteenth in deaths from childbirth.

Fig. 1. Patient draped for delivery with abdominal sheet tucked under back to show hip rest which is used to elevate hips during delivery of child. Pain is relieved with intermittent nitrous oxide-oxygen analgesia and the patient pulls on the straps as directed. Ether is added if needed during the last few "pains" and is usually administered for the repair of the episiotomy. With this hip elevation and technique it is not necessary to shift patient for mid or low forceps and there is no difficulty in delivery of aftercoming head in breech cases.

In a brief paper, it is obviously impossible to state even in outline all that has been done to make childbearing safer. Nor can credit be given to all who have helped develop the scientific procedures now in use.

Perhaps the greatest problem which confronted the early obstetricians was puerperal sepsis. Prior to the observations of Holmes and Semmelweiss the history of hospital maternities is to a great extent one of childbed fever. Nor were the epidemics confined to the hospital for in 1786 there was an outbreak in the plains of Lombardy from which not a single puerpera recovered. Today we have ample proof from the records of many maternities that puerperal sepsis is a preventable complication. The continued large number of deaths from it is certainly a strong indictment of general medical conditions. This is due in part to inadequate training of medical students, but still more to the subsequent difficulties of maintaining technique when the physician tries to do obstetrics in competition with the local midwife, working under similar conditions without means of maintaining asepsis or properly handling complications. Hospitalization is the only solution.

Craniotomy, the most repulsive of surgical procedures, while perhaps the oldest of obstetrical operations, is today rarely performed.

Except for the draining of fluid from a hydrocephalic monster it is not performed on a live child. The induction of premature labor, podalic version and axis-traction forceps led to a gradual reduction of the number of craniotomies performed during the past few centuries. Early recognition of actual disproportion and cæsarean section performed according to present surgical standards has led to a practical elimination of the operation. The Porro cæsarean and the more recent low cervical incision make it possible at times to do an abdominal delivery even when the previous handling of the labor is not above reproach.

After craniotomy, abdominal hysterotomy, long known as cæsarean section is the oldest obstetrical operation. It may even antedate craniotomy as it is known to have been performed by primitive peoples in Africa, and doubtless was at times resorted to by primitive peoples of the remote past. Long ago it was performed by Priests after the death of the mother.

Before the antiseptic and aseptic periods of surgery, however, cæsarean section was fatal in such a high percentage of cases, that it was rarely attempted. In the early antiseptic period 150 Porro operations showed a mortality of 54 per cent. While a little later when Saenger returned to the conservative operation there was a maternal mortality of 40 per cent in 40 operations (Englemann). Today the maternal mortality from cæsarean section is between 5 and 10 per cent, but in elective operations it should not exceed 1 per cent.

Cæsarean section is such an easy method of delivery and such a time-saving procedure, that since it is now relatively safe for the mother and practically insures a live baby, there is a growing tendency to resort to it at once when the labor promises to be difficult or tedious. While at the time the results may be very gratifying, yet it must be remembered that of every 100 women who have subsequent pregnancies, four or five may be expected to have a rupture of the uterus. While in the future there will be even more cæsarean sections performed than today, it is hoped this will result from a more careful selection of cases rather than due to a continued broadening of indications.

Prenatal care, securing as it does an early exmination of the prospective mother, and a continued careful observation during the course of pregnancy, has demonstrated that the severe toxæmias are for the most part preventable. While it has not been possible to eliminate the early nausea and vomiting, we are now able to relieve the patient, and today it is very rarely necessary to terminate the pregnancy because of vomiting. Early removal of all foci of infection with careful regulation of diet and limitation in the increase of weight will to a great extent prevent the late toxæmias. Prompt eliminative treatment, and when this fails, premature induction of labor has largely removed the danger of eclampsia. With evidence of kidney suppression and an impending eclampsia, the slow intravenous administration of 18 to 20 per cent glucose solution will usually improve kidney function. The substitution of morphine for chloroform when convulsions do occur means a saving of lives. Threatened eclampsia is not, *per se*, a proper indication for cæsarean section.

Ideal handling of an obstetrical case entails caring for a woman during pregnancy, labor, and the puerperium in such a way that she will come through with a healthy baby and without impairment of her own health. However, the average woman thinks little of the possible dangers, accepting them as the sacrifice which she must make. The pain of labor, temporary and intermittent though it is, causes her more worry than any of the possible complications. Gradually, since the day of Simpson, methods have been devised to control this pain, until today the woman may be carried through labor with comparative comfort. The day has passed when a woman in labor should be permitted to suffer to such a degree that the entire hospital is disturbed by her cries. Judicious use of hypodermic medication during the first stage and nitrous oxide-oxygen or well-vaporized ether during the second stage makes labor more bearable, and today obstetrical patients should be as quiet as surgical. That this sort of care requires more careful watching dur-

ing labor is perfectly true—however, obstetricians who deliver women with the minimum of pain would forsake obstetrics before returning to the old method with its confusion and unbearable shrieks. Relief of pain during labor conserves the woman's strength, lessens the dangers of complications during the puerperium, and favors an early recovery. Primitive women may have had an easy labor and little discomfort, but civilized woman has a highly sensitive nervous system and her pain is real. More than 30 years ago Lusk warned us that: "As the nervous organization loses in the power of resistance as the result of higher civilization and artificial refinement, it becomes imperatively necessary for the physician to guard her from the dangers of excessive and too prolonged suffering."

During the past few centuries the care of women in childbed has been gradually transferred from the practical midwife of the community to the family physician. The early benefits of this transfer is apparent from the lower mortality shown in the following table.

AVERAGE NUMBER OF MOTHERS DYING IN CHILDBED IN LONDON

For 20 years ending in 1680,	one in every	44 delivered
For 20 years ending in 1700,	one in every	56 delivered
For 20 years ending in 1720,	one in every	69 delivered
For 20 years ending in 1740,	one in every	71 delivered
For 20 years ending in 1760,	one in every	77 delivered
For 20 years ending in 1780,	one in every	82 delivered
For 20 years ending in 1800,	one in every	110 delivered
For 20 years ending in 1820,	one in every	107 delivered

In 1840 one woman died in childbed for every 168 women delivered in England and Wales. But in the birth registration area of the United States, one woman died, in 1915, for every 164 live births.

The practical midwife is rapidly being eliminated. During the past 10 years, the number of midwife deliveries in Milwaukee has dropped from 4,198 in 1911, to 1,988 in 1920. The number of confinements conducted by physicians has for the same period increased from 6,689 to 9,088. If in the future there is not a further lowering of the mortality and morbidity from childbirth, physicians must take the blame. For all women of childbearing age (15 to 45) childbirth is the second greatest cause of death. The records of life insurance companies show that for all women insured before the age of 45, the diseases of pregnancy and the puerperal state are the second greatest cause of death. All women are exposed to tuberculosis or it could not hold its lead over childbirth as a source of danger to the younger women.

The greatest obstetrical need of today is not more knowledge regarding its complications, but rather, to use a commercial term, better distribution. A delivery is an operation. It is just as safe to put a finger into the peritoneal cavity as into the vagina during labor, and the technique for one should be as rigid as for the other. Emergency operations are still performed in a house when necessary but not from choice. Surgeons require their patients to go to hospitals. Many hospital beds are now used for medical cases. People are educated to the great advantage of going to a hospital for a diagnosis or an operation. A few obstetricians, require their patients to go to the hospital. Safe care in the home is possible, but this means turning it into a hospital for the time and for the average family the cost is prohibitive. The family physician is asked to deliver his patients in a bedroom or kitchen, without the facilities or assistance to meet possible complications. A careful technique is almost impossible. And yet we wonder why childbirth remains so dangerous in an age when surgery is relatively so safe?

DEPARTMENT OF TECHNIQUE

THE "BIPP" METHOD OF TREATMENT

Bone Cavities and Bone Grafts

By RUTHERFORD MORISON, M.A., D.C.L., LL.D., M.D., F.R.C.S.(Edin.), F.R.C.S.(Eng.),
Newcastle-upon-Tyne, England
Professor of Surgery, Durham University

IN several addresses and papers I have drawn attention to the "bipp" method of treatment of war wounds, and early in 1918 I summarized all of my information in a small book entitled *Bipp Treatment of War Wounds* and published by the Oxford Press.

In all of my publications I have claimed that by this method, properly applied, it is possible to close infected wounds without drainage, always with impunity and frequently with the result that "healing by first intention" follows.

This is a big claim for it means that a new surgical principle has been established, viz., that if an infected wound be treated by (1) thorough operative measures and (2) suitable antiseptic methods it often need cause little more trouble than a clean one does. I do not claim that the last word has been said yet, but it is possible at the present time to get results which are startling to those who have not carried out this treatment according to the ritual I have described. That it may be more difficult than I have appreciated is suggested by my experience with junior colleagues at the War Pensions Hospital, all good and enthusiastic surgeons (Mr. Cuff, Mr. Russell, and Mr. Irwin). They had tried the "bipp" method in many cases, sometimes with excellent results but also with not infrequent failures, before I joined them. After participation in my work, they obtained as good results as my own, and did not hesitate to acknowledge that the change in their methods had brought about a remarkable improvement in their cases.

It is so difficult to convince the majority of surgeons that their outlook may be wrong that the strongest possible evidence to this effect is necessary, and it has to be offered over and over again before it has any chance of gaining acceptance. Bacteriology has done so much for surgery that surgeons are for the present obsessed by it, and most of them will listen to nothing except it be fully supported by bacteriologists of repute. It will be many years yet before infected wounds are sufficiently understood to be satisfactorily treated on strictly scientific lines, and though that ought to be the ideal of every surgeon, he should not shut his eyes to the fact that it is so far an unattainable one, and, by refusing to accept proofs that some surgical progress may still be made by clinical experiments, retard surgical advance. Patients occasionally consult me "because they have heard that I have found a salve which heals wounds very quickly," and even doctors sometimes appear to think in a similar way. Nothing could be further from the truth. The whole method demands attention to the principle and every detail of it. The "salve" *may* be the least important portion, though for the present I do not think so, having found nothing equally efficient.

When I recall the condition of my wards at the Northumberland War Hospital, with 80 beds under the care of a house surgeon and myself, I am still overwhelmed when I remember the wave of enthusiasm I felt when the dreadful conditions existing then could be said to have been brought to a conclusion. We soon found in our first year that any interference with these painful infected wounds, except to keep them as clean as possible, did more harm than good, and surgery eventually had to be limited to drainage and frequent painful dressings. All the nurses and orderlies were overworked, and the dressings required so much of their time and attention that there was little chance of their being able to do much for the patients outside of these performances. My own feeling then was one of desperation, because so little could be done.

As a contrast to this I will mention our experience during the last year, when Dr. Pirrie

[1] An address given to the Northern Division of War Pensions Surgeons on April 28, 1921, and a demonstration at the meeting of the British Medical Association, on July 20, 1921. Published by leave of Colonel Greig, War Pensions Hospital, Newcastle-upon-Tyne.

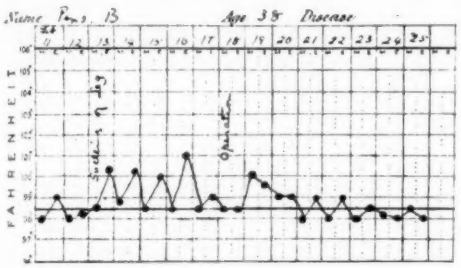


Chart 1. Case 1, showing temperature curve.

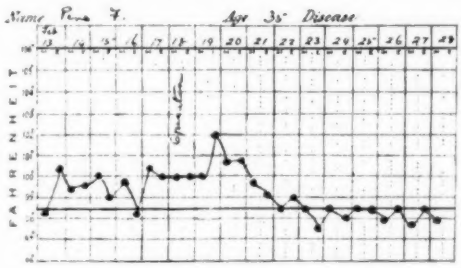


Chart 2. Case 2, showing temperature curve.

and I had almost three times the number of beds (200) under our charge. Every serious wound was treated by operation and the "bipp" method, and the consequence was that all dressings, except the minor ones, were done in the operating theater by Dr. Pirrie and myself on one or two mornings of the week, nurses and orderlies were freed from this work to attend to the wants of the patients, and no member of the staff was overworked. The change in the whole aspect of the wards was more remarkable still. Instead of being filled with an ill, complaining crowd of patients they were full of cheerful men, whose chief anxiety seemed to be to know when they could get up.

Though the "bipp" method has not so many opportunities of proving its value now, it has still many uses both in civilian and military service.

During the last years of the War, Mr. Richardson tested it in the Royal Victoria Infirmary by treating a series of compound fractures by "bipp," then fixing them with Lane's plates, with extraordinarily good results which I hope may be published.

My own War Hospital results with fractures without plates were also surprisingly good, for the majority, after we had learned how to treat them, were no more trouble after operation than simple fractures are.

The advantages of the "bipp" method of treatment were also emphasized by our results in cases of bone necrosis following gunshot wounds. Before adopting this method, wounds, following necrosis operations, were left widely open for drainage, but in spite of taking all the precautions known to us, septic "flares up" and more necrosis frequently followed our operations. I recall especially the case of a young soldier with necrosis of his femur following a gunshot fracture, on whom I operated four times for the removal of sequestra. Each of the first three operations was followed by an acute flare up and further necrosis of the bone exposed and damaged by the operation. On the fourth occasion the "bipp" method was adopted, and the wound, closed by sutures, promptly healed without trouble.

The first cases I have to show you are men who had large acute abscesses opened, "bipped," and closed by sutures.

CASE 1. Pens. B., age 38. In the end of November, 1920, patient noticed a carbuncle on the back of his neck. This became irritated, because the top rubbed off when he was working in the mine. Since then he has had abscesses (1) end of December, in his right hip; (2) end of January, in his left leg below the knee; (3) about the beginning of February, in his side. All the abscesses were opened.

On admission January 12, 1921, he was very ill with bronchitis. He had a bedsore on his back, a carbuncle over his scapula, and another over his hip bone.

February 13, 1921. Large swelling on right leg, outer side, just below knee. Some œdema and redness of skin covering abscess. Deep fluctuation over area 4 inches by 3 inches.

February 18, 1921. Operation. Five-inch incision between tibialis anticus and extensor communis digitorum. Abscess found extending down to interosseous membrane. It was lined by a thick pyogenic membrane. About 1 ounce of pus was evacuated. Abscess cavity treated with "bipp" technique. Skin sutured with interrupted sutures of silkworm gut. Dry dressing. Boric powder on skin. No splints.

Bacteriological report on pus from abscess. Staphylococcus aureus present.

February 27, 1921. Dressed first time (9 days later). Pus was escaping between sutures, but no sign of inflammation and no tenderness were present. Sutures were still in position. To be dressed daily with spirit. Sutures left in.

March 8, 1921. Temperature 101°. Patient complained of pain "like rheumatism" all over his body. No discharge on dressing. No pus could be squeezed out of wound.

March 14, 1921. Right leg healed. Patient has had a slight, tender swelling in right flank resembling a threatened perinephric abscess.

Summary. Acute abscess holding 1 ounce of pus opened, "bipped," and closed by sutures. Healed in 15 days.

Though this abscess did not heal by first intention, all the symptoms, including the rise in temperature, disappeared immediately after

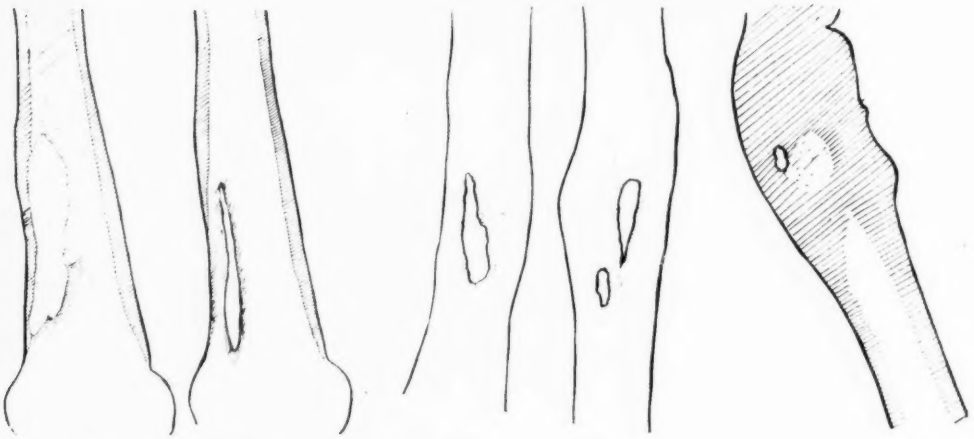


Fig. 1. Fig. 2. Fig. 3. Fig. 4. Fig. 5.

Fig. 1. Drawing showing condition in Case 5 before operation.

Fig. 2. Drawing showing condition in Case 5, 6 months after operation.

Fig. 3. Condition in Case 6, 131 days after operation.

Fig. 4. Condition in Case 6, 222 days after operation.

Fig. 5. Drawing showing condition in Case 7, 126 days after operation.

it was opened and no extension of it followed closure of the incision by sutures.

The patient's resistance was much diminished by general weakness, prolonged sepsis, and the formation of many metastatic abscesses.

CASE 2. Pens. F., age 35. Gunshot wound left arm (fracture). Left thigh. Wounded October 16, 1917, France, by shrapnel. He was wounded all down his left side—face, arm, chest, and thigh. The thigh wound healed in January, 1918—no operations. His left arm was bone grafted for ununited fracture of radius in March, 1920.

February 2, 1921. Patient was admitted to the War Pensions Hospital for further treatment of his left arm. On February 7 he had pain in his wounded left thigh, which had been healed since 1918—no shiver. On February 13 his temperature was 100.4° and there was a large swelling in his left thigh. The skin over the abscess was red and œdematous.

February 18, 1921. Operation. Four inch incision. An abcess containing 1.5 ounces of pus underneath the tensor fascia femoris was opened. Cavity treated with "bipp" technique. Skin sutured with interrupted silkworm-gut sutures.

Bacteriological report on pus from abscess. Pure culture. Streptococcus. Hæmolytic.

February 21, 1921. Patient running temperature—dressed. Some bloody discharge could be squeezed from wound between sutures. Specimen was sent for bacteriological report. Wound was not tender at all. Redness and swelling gone. Bacteriological examination showed no growth.

February 27, 1921. Healed apparently by first intention. No further trouble.

Summary. Acute streptococcic abscess opened, "bipped," closed. Healed by "first intention."

In this patient a more virulent organism than in the first case shown was the cause of the abscess. His temperature consequently did not drop at once after the abscess was opened.

In spite of the organism and the acute inflammation, the wound healed right away.

CASE 3. Pens. M., age 24. Gunshot wound left hand. Wounded in left wrist October 26, 1917, at Ypres. The wounds healed but kept breaking down. Several operations were performed. The thumb did not give trouble until February, 1920.

On admission February 23, 1920, there was found a sinus in palm over third metacarpal bone; two sinuses on wrist, one over flexor carpi radialis 2 inches above insertion, the other on medial surface of lower third of left forearm. Profuse discharge.

Lysol baths were given left hand, fomentations every 3 hours.

March 6, 1920. The hand was incised. Extensive necrosis was found. The flexor carpi radialis tendon was exposed and found separated from the adjacent tissue. Sinuses were incised and enlarged.

June 1, 1920. Sinuses in hand and forearm were still discharging freely.

August 4, 1920. There are two sinuses of tuberculous appearance and the size of a sixpence over flexor aspect of thumb (left); sinus in middle of left palm. Two sinuses were present in lower third flexor aspect of forearm. A large acute abscess extends from lower sinus backward over ulna and reaches to posterior surface above the elbow joint.

August 6, 1920. Operation. Professor Morison. Abscess in upper arm and forearm opened by long incision. Carious bone area size of sixpence, over external condyle of humerus. Pus burrowing from thumb to palm and up forearm in flexor sheath. Much dirty tuberculous-looking granulation removed from palmar synovial pouch and from a sinus extending deeply among flexor muscles to junction of middle and upper third of forearm. Sinus was opened up and tuberculous septic débris removed as far

as possible by dissection and Volkmann's spoon. All diseased area cleansed with dry gauze and spirit gauze and then "bipped." Long incision closed with bipped" silk sutures. Arm put up in plaster of Paris from finger tips to shoulder.

Bacteriological report on pus from acute abscess. Tubercle Bacilli detected by sedimentation test (few). Culture sterile.

August 10, 1920. Arm is much easier. Patient has been feeling better and has been out on balcony since yesterday.

August 13, 1920. Allowed up.

September 17, 1920, wound dressed first time—6 weeks after operation. Dressing dry with exception of one drop of moisture from thumb. Sutures removed. Wound in palm healed. Incision in thumb a linear wound, with a few granulations here and there. Forearm wound healed where incision was made. Two granulating areas where old sinuses were, one at upper end one-fourth inch by one-eighth, lower one the size of a split pea. On inner side of thumb is a small granulating area, also the size of a split pea.

The wound over dorsal ulnar aspect of upper arm and forearm healed except for 2 granulating areas over external condyle of humerus, size of split pea. The silk sutures had left small (pin-head size) granulating areas where they were removed. Dressed with "bipp." Arm put up as before in plaster of Paris from finger tips to shoulder.

October 6, 1920. Swelling developed in left iliac region. Marked impulse on coughing. Psoas abscess. Angular curvature dorsolumbar region—spinal caries. To go to bed on balcony and wear spinal jacket.

October 15, 1920. The abscess in iliopsoas sheath was opened by 6-inch, oblique, incision and about 1 pint of pus evacuated. The cavity was cleaned out with dry gauze, spirit and "bipp." The wound was completely closed.

Bacteriological report on pus. No tubercle bacilli detected. Culture—no growth.

October 21, 1920. Swelling on plantar surface of left foot which has broken down. Foments. A small tuberculous abscess also has burst in perineum.

October 29, 1920. Second dressing of arm. Absolutely dry except for a small granulating area on medial side of thumb—ulcer about size of coffee bean. Bipped." Splint left off. Side (iliopsoas abscess) dressed. Perfectly dry and healed by first intention. Sutures removed. Spirit dressing.

November 6, 1920. Foot quite dry and healed.

November 20, 1920. Thumb healed. Complained of pain in back—nothing to be found.

December 13, 1920. Iliac wound has broken down for half inch on its surface and is discharging a little. Dressed with flavine.

January 6, 1921. Very little discharge from iliac wound. Patient looking fatter and better.

January 31, 1921. Thumb wound has broken down a little. Movement in fingers is improving.

March 7, 1921. Thumb healed. Iliac wound almost healed—just a little surface moisture.

This case is the most extraordinary one in all my surgical experience. The arm appeared to be a hopeless mess at the time the operation was undertaken, and amputation through the upper arm suggested itself as the most reasonable course.

How wrong that would have been is evident now as the arm, though still carefully protected, is almost fully restored to its function.

Fig. 6 (at left). Roentgenogram, Case 8, taken January 4, 1921, 100 days after operation.

Fig. 7. Roentgenogram, Case 8, taken April 12, 1921, 206 days after operation.

Mr. Wade's introduction to the discussion on the "Treatment of Acute Pleural Empyema" encourages me to relate the case of a soldier who was admitted to the Northumberland War Hospital in 1916, with acute wound sepsis.

He was wildly delirious, and had to be restrained by straps in bed. While in this condition he developed acute pleural empyema. After repeated aspiration had failed to arrest the effusion I opened his chest widely, letting out more than a pint of pus, treated his pleura with the "bipp" method, and closed the large wound entirely with catgut sutures. The wound was smeared with "bipp" and owing to his mental condition no dressings were applied. This patient at once began to recover and his wound healed by "first intention." I have not dared to publish the case before as it seemed to me that it would only be regarded as too good to be true, or a lucky chance.

Bone Cavities

In the book previously mentioned (*loc. cit.* p. 28 and seq.) in reference to filling bone cavities with fat grafts I write: "No bone graft will live in a septic cavity or in the presence of irritating antiseptics. After proving that skin grafts could survive treatment by our method ("bipp") we adopted free fat grafts as best and most easily obtainable, and have now had so many successful cases that we feel justified in saying that recovery should be the rule, and an explanation of failure should be carefully sought for. . . .

"If there is any tension on the wound edges when the sutures are removed, fat appears at the

Fig. 8. Roentgenogram, Case 9, taken October 4, 1920, showing condition before operation.

Fig. 9. Roentgenogram, Case 9, taken January 11, 1921, 38 days after operation.

Fig. 10. Roentgenogram, Case 9, taken June 20, 1921, 105 days after operation.

bottom and healing is much delayed, though the grafts have never in our experience been extruded. . . .

"After months of daily dressing and discharging these cases may be expected to heal in a few weeks. It is interesting to watch in X-ray pictures replacement of the fat by bone."

Three more years of experience have confirmed all of this, and now I have overwhelming evidence in support to give you. The chief difference between then and now is that years instead of months have elapsed since the wound and fracture which resulted in a bone cavity, the patients are not so physically fit and are more often in a hopeless frame of mind after undergoing a series of operations which have failed to cure them. It was impossible for me to offer statistics from the Northumberland War Hospital in support of my views, because the patients were kept there for as short a time as possible, and after leaving hospital many of them could not be traced. Possibly for this reason so little importance has been attached to my work that in the latest book on the *Orthopædic Surgery of Injuries*, edited by Sir Robert Jones and published this year, Mr. Elmslie who has written the article on bone cavities, excellent in every respect except in the treatment of them, never mentions fat grafts though he approves of the "bipp" method of treatment of the cavity.[1] Where the cavity cannot be obliterated by flattening out its walls, he uses a muscle graft and *drains*.

For any cavity which can be made shallow enough without seriously weakening the bone, all are agreed that this method is easiest and best, but in the most serious cases nothing short of filling the cavity with some sort of graft will suffice. In the great majority of my cases, multiple fat grafts have been used, in some muscle and fat, in others muscle alone. I have not used muscle which could perform its proper function for this purpose.

Since working at the War Pensions Hospital I have been able to follow up all of my cases and am now able to say definitely that there has been no failure, and that no bone cavity has been discharged from our supervision until healed and after a test of 10 days' exposure to radiant heat has proved that it is unlikely to break down again.

Omitting any reference to the minor cases cured by the removal of sequestra, chiseling

[1] At the British Medical Demonstration in July, 1921, Mr. Elmslie stated that his article was written before my book was published.

away the walls, application of "bipp," and immediate closure by interrupted sutures. I have notes of 20 cases, operated upon during the last year, of large bone cavities, all but one treated by grafts. One of these cases it will be noted dates back as far as 1914, and all of them had undergone multiple operations which had failed to cure the discharging sinus for which they were admitted.

The fact may be recognized that radical operation in these cases may be a difficult and prolonged one, and it always requires patient, persistent perseverance. A large incision is essential to allow of proper access and it is important to remove sufficient of the sclerosed bone covering the cavity to *see* every part of it. The most difficult cases are those in which the entire bone has been perforated by the missile. A striking example of this occurred to me in the femur. There was a long discharging sinus on the front of the thigh in the center of a large scar, and there was a *healed* scar opposite to this on the *back* of the thigh. A sequestrum was removed from a pocket in the *back* of the thigh bone after 2 hours' hard work. It is very easy to miss a sequestrum lying either in the bone or soft parts on the side opposite to the discharging sinus and nearer to the healed scar.

A skilled assistant should take out every particle of bone as it is separated, otherwise healing of the wound may be delayed until it is taken out or extruded. When possible the operation should be done with a tourniquet to allow of satisfactory inspection and to prevent the serious loss of blood which may follow one hour or more of operating. If there is any doubt felt as to *seeing* the whole cavity, aided by a bull's eye light, I pack it with "bipped" gauze, close the incision by interrupted sutures over this, and at the end of 2 weeks dress the wound, take out the sutures, reopen it, remove the gauze, fill the cavity with fat grafts, and resuture, if there is no sign of wound infection.

The fat I prefer is taken from the outer side of the thigh and overlying the fascia lata. It is more fibrous and less greasy than that from the abdominal wall.

There must still be hundreds of men incapacitated by chronic bone sinuses, and the proper treatment of them is a matter of importance to the country. Their health and working capacity are undergoing gradual deterioration and many of them become seriously ill from "flares up" from time to time. This is my reason for placing such great emphasis upon the subject in this address.

Fig. 11. Roentgenogram, Case 10, taken September 29, 1920, before operation.

CASE 4. Pens. L., age 33. Gunshot wound left leg. Fractured tibia. Wounded August 26, 1918, by a machine-gun bullet, when going over the top. Bullet went through both legs. He lay for 4 days before being picked up—got caught in barbed wire when crawling in. The right leg healed at once—bullet went through without touching bone. Four operations had been done on left leg before admission.

On admission May 6, 1920, there was a scar on outer and inner aspect middle of left leg. Some discharge from inner wound. X-ray showed large cavity in tibia with sequestrum.

May 29, 1920. Operation. Mr. Cuff. Scar and sinus excised by 4-inch incision. Edges of cavity rounded off with chisel. Small sequestrum (size of pea) removed. Cavity scraped with spoon, "bipped," and wound closed with "bipped" silk.

June 22, 1920. Second operation. Mr. Cuff. Edges of wound excised, cavity thoroughly scraped and smoothed off. Scrubbed out with gauze, spirit and "bipp" rubbed in. Small pieces of fat were removed from abdominal wall and cavity filled with same. A long flap, 7 inches by 2 inches, was cut on outer surface of wound and pulled over cavity and secured *in situ* with "bipped" silk.

July 13, 1920. Dressed first time—21 days after operation. Good deal of discharge. Fat exposed. Looking well—no pus.

September 6, 1920. Fat still exposed. Wound now dry.

October 6, 1920. Wound still dry—diminishing in size. Fat showing as before.

Fig. 12. Roentgenogram, Case 11, before operation.

Fig. 13. Roentgenogram, Case 11, taken April 4, 1921, 152 days after operation.

Fig. 14. Roentgenogram, Case 11, taken July 11, 1921, 250 days after operation.

December 6, 1920. Fat lying unchanged at bottom of gap.

January 10, 1921. Now an elliptical granulating wound, 1 inch long by 1/8 inch wide at lower end of incision. Fat still exposed at bottom of it. Closing in.

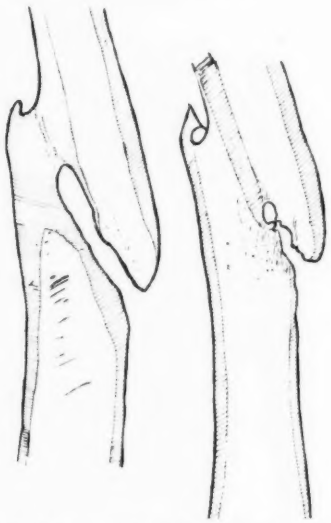


Fig. 15 (at left). Condition, Case 12, before operation.
Fig. 16. Condition, Case 12, after operation.

February 7, 1921. Fat still showing.

March 7, 1921. Fat now covered by granulations. Dressed "bipp."

March 21, 1921. Closing in quickly.

April 18, 1921. Healed.

June 13, 1921. Finished radiant heat treatment. Soundly healed.

Summary. Pens. L., age 33, wounded August 18, 1918. Fractured tibia. Five previous operations. Last operations (by Mr. Cuff). May 29, 1920, first operation; June 22, 1920, second. Healed April 18, 1921—10 months.

CASE 5. Pens. W. Gunshot wound of left thigh; compound fracture femur; amputation left forearm. Wounded September 7, 1916, by shrapnel. The wound was healed from November, 1917, until January, 1918, when it broke down again. Since then he has had 10 operations—he cannot remember how many he had before.

Notes from English Hospital. February 21, 1919. Shell wounds lower third left thigh with discharging sinus, marked œdema of this area, also of knee joint in which there is slight fluctuation present. Amputation of left forearm 2 inches below elbow joint—healed.

March 23, 1919. X-ray shows large cavity in femur. Operation: Cavity scraped, no sequestrum present.

May 16, 1919. Operation: wound opened up freely, abscess cleaned out, much bone chiseled away, abscess in medulla opened, chiseling bone cleared—flavine; bone chips placed in cavity.

May 26, 1919, better—cavity rather septic.

June 2, 1919. Cleaned. Transferred.

July 4, 1920. Returned to Central Hospital for further treatment. Diseased bone.

September 29, 1919. Operation. Large cavity in lower end of femur opened up. Sequestrectomy. Sutured.

November 18, 1919. Discharges offensive and purulent. X-ray showed more sequestra.

Fig. 17. Condition, Case 13, before operation.

Fig. 18 (at left). Roentgenogram, Case 14, taken November 17, 1920, before operation.

Fig. 19. Case 15, taken November 17, 1920, before operation.

November 21, 1921. "Bipp" and olive oil in equal parts.

January 29, 1920. For operation. Transferred.

May, 1920. Operation: sequestrectomy.

June 15, 1920. Operation. Professor Morison. Scar and sinus on outer aspect lower third of left thigh excised. Muscles incised down to bone and retracted. Cloaca enlarged with gouge and larger gutter cavity (4 inches) exposed. This was cleaned out with gouge and spoon, and dry gauze, swabbed with spirit, and "bipped." The incision was carried up for another 3 inches and four plugs of subcutaneous fat cut, and cavity filled with same. The muscles were then sutured with catgut.

A large flap was cut by curving lower part of incision down, out and up, pulling over wound, and suturing with "bipped" silk.

July 2, 1920. Dressed first time. Not healed. Flap dusky. Not much discharge.

July 16, 1920. Flap sloughed and fat exposed.

October 22, 1920. Still a large unhealed area where skin flap sloughed and a good deal of discharge. Dressed flavine.

November 6, 1920. Much less discharge. Wound probed —bare bone could *not* be felt. No fat had ever come out.

January 10, 1921. Little pus coming, from surface apparently, at lower end of wound. Rest of wound healed.

January 31, 1921. Still a good deal of pus could be squeezed up from under skin at lower end of wound.

February 14, 1921. Lower end of wound opened up under local anæsthetic, and a quantity of pus and a small piece of bone evacuated.

February 27, 1921. Very little discharge from lower end of wound.

March 7, 1921. Very nearly healed. Hardly any discharge on 3 days' dressing.

March 21, 1921. Healed. For radiant heat treatment.

April 4, 1921. Finished radiant heat treatment. Soundly healed. For discharge.

Summary. Pens. W., age 21. Wounded September 7, 1916. Large bone cavity in femur. Many previous operations—more than ten. Last operation July 2, 1920 (Professor Morison)—cavity filled with fat grafts. Skin flap sloughed. Healed March 21, 1921—8 months.

Case 6. Pens. J. E. S., age 21. Gunshot wound right thigh with fractured femur. Bullet in liver. Wounded October 9, 1918, by a machine-gun bullet when going over the top. A bullet was removed from his liver at a C. C. S. Has had 10 operations on femur. X-ray shows cavity in femur.

Note from English Hospital October 23, 1919. "Patient wearing caliper splint ½ inch extra sole to boot. Long linear scar along lateral surface of right femur. Healed except for persistent sinus in middle of scar. Complete ankylosis of knee joint. X-ray shows old fracture of femur with cavity in bone and sequestrum."

August 31, 1920. Operation by Professor Morison. Tourniquet used. Longitudinal incision, 12 inches in length with sinuses in middle part of it. Cavity in bone exposed and a considerable amount of unhealthy granulation tissue found lying in lowermost part of medulla. Cloaca enlarged and all overlying bone tissue removed. Sclerotic tissue chiseled away. Several tracks in bone opened up. The bone cavity was found to open on to popliteal surface of femur. A large graft of the vastus externus muscle was placed in the cavity after the latter had been cleaned by "bipp" technique. Tourniquet removed. Wounds sutured with catgut. "Bipped" silk for skin. Put up in plaster-of-Paris.

September 1, 1920. Discharge through twice in night. Pickled with spirit and boric powder.

September 4, 1920. Been running temperature—101.8°; 100.2°; 101.8°; 99.8;° 100°; 99.8°. Discharge through again in night. No pain. Feels better.

September 6, 1921. Still running temperatures so dressed. Some moisture (about 2 drams) on dressing. Wound in center has opened up for ¼ inch, otherwise no redness, no œdema, and no evidence of anything wrong. Spirit dressing.

September 13, 1921. Being dressed daily. Little serum. Looking well—wound not opening up. Patient out on balcony.

October 1, 1920. Patient complained of abdominal pain, temperature 101.6°.

Fig. 20. Roentgenogram, Case 16, taken November 9, 1920, before operation.

Fig. 21. Roentgenogram, Case 16, taken April 12, 1921, 68 days after operation.

Fig. 22. Roentgenogram, Case 16, taken April 12, 1921, 68 days after operation.

Opening ¼ inch by ¼ inch in center of wound of oval shape with sinus in middle of it, from which there had been about ½ dram discharge.

October 3, 1920. Temperature 99°.

October 4, 1920. Temperature normal.

October 18, 1920. Wound appeared superficial. To be dressed with flavine and castor oil.

October 30, 1920. Healed.

December 13, 1920. Has had 14 days' radiant heat treatment. Soundly healed.

Summary. Pens. J. E. S., age 21. Wounded October 9, 1918. Fractured femur. Large cavity. 10 previous operations. Last operation (Professor Morison) August 31, 1920. Healed October 30, 1920—2 months.

CASE 7. Pens. G., age 23. Gunshot wound left thigh. Wounded April 27, 1915, by a rifle bullet. The bullet went right through fracturing the femur. He had 6 operations, but the outer wound has never healed. There is an operation incision underneath the thigh which, he says, also keeps breaking down and discharging.

September 16, 1920. Operation. Professor Morison. Sinus probed and bare bone felt. Elliptical incision was made 8 inches long, excising scar, down to bone. A sequestrum was found while the unhealthy granulations were being cut away. The periosteum was peeled back from the bone. The whole wound was "bipped." Some dead bone and unhealthy tissue were removed and the bone cavity exposed—about the size of a sparrow's egg. The edges of cavity were chiseled away and some necrotic bone removed. Three sequestra were found in the depths of cavity. When chiseling was completed the cavity was the size of a bantam's egg. A probe passed through the under sinus did not touch bone. The sinus was enlarged but no bone was found. The bone cavity was cleaned with spirit and "bipped." Packed with strips of "bipped" gauze—to be left for a month and then fat grafted.

Relief incision made 2 inches outside operation wound —of same length and parallel to it, and bridge of skin between undermined to allow closure over gauze in cavity without tension. Sutured with "bipped" silk. Edges of tension incision on each side sutured with "bipped" silk, to muscle fascia to diminish raw surface. Bridge of skin scored. Dressed strips of oiled silk and dry gauze. Small under sinus "bipped."

October 15, 1920. Second operation. Professor Morison. Wound, which was healed, opened up, and gauze pack

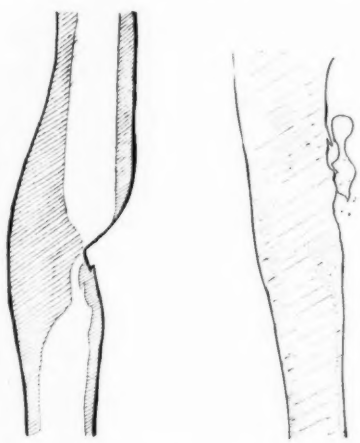


Fig. 23 (at left). Drawing, Case 17, showing condition before operation.

Fig. 28. Drawing showing condition in Case 20 before operation.

Fig. 24 (at left). Roentgenogram, Case 18, taken March 15, 1921, before operation.

Fig. 25. Roentgenogram, Case 18, taken July 12, 1921, 103 days after operation.

Fig. 26 (at left). Roentgenogram, Case 19, taken March 29, 1921, before operation.

Fig. 27. Same as Fig. 26.

removed with difficulty, as the gauze was infiltrated by granulation tissue; cavity was scraped out gently with a sharp spoon. No sign of sepsis present. Cavity was cleaned with spirit and "bipped." Incision about 8 inches long was made on right thigh and 4 pieces of fat overlying fascia lata removed from this and placed in cavity in left femur. The wound was completely closed by interrupted sutures of "bipped" silk. Whole surface "bipped." Incision on right thigh sutured. No splints.

November 6, 1920. First dressing since second operation (3 weeks). The wound over cavity all dry and whole—healed by first intention. Tension incision clean and granulating—the whole length of incision varying in width from ¼ inch to ½ inch. The skin gradually covering over at edges. Wound dressed with oiled silk and saline, after being washed with spirit.

December 4, 1920. Some inflammatory swelling in middle of scar—to be fomented.

December 6, 1920. Abscess burst. A very little blood-stained pus evacuated. "Bipp" dressing.

December 8, 1920. Still a few drops of discharge (pus mixed with "bipp").

December 13, 1920. Appears to be soundly healed.

January 24, 1921. Small discharging sinus in middle of scar over bone cavity—where abscess formed and opened.

February 7, 1921. No discharge but not quite soundly healed. Flavine.

February 14, 1921. Healed. To have radiant heat treatment.

March 14, 1921. Has had radiant heat treatment for a month. Soundly healed—never broke down under it.

Summary. Pens. G., age 23. Wounded April 27, 1915. Fractured femur. Large cavity. 6 previous operations—never healed. Final operations (Professor Morison): First stage, September 16, 1920; cavity cleaned with "bipp" technique; second stage, October 15, 1920; wound healed over "bipped" gauze. Opened up. Cavity filled with fat grafts. November 6, 1920. First dressing (3 weeks). Wound over cavity healed by first intention, but broke down in center later (December 4, 1920). February 14, 1921, soundly healed—4 months.

CASE 8. Pens. T. S., age 25. Gunshot wound left leg. Wounded October 4, 1918, by a bullet, near St. Quentin. Has had 7 operations—the most recent on September 2, 1920. Never healed.

Notes, C. C. S. October 4, 1918. Entrance wound about middle of inner side left leg. Exit in front of leg (fracture). Redressed back splint. French Hospital: leg swollen and tender (wound excised).

October 7, 1918. First operation. P. drain. Wound enlarged and fragments of tibia removed.

October 10, 1918, Scotch Hospital: Lacerated through-and-through wound mid-shaft of tibia (left) very dirty, a good deal of inflammation.

October 16, 1918, X-ray report "Comminution and partial destruction of middle of shaft of tibia."

October 30, 1920. Patient greatly improved. Wound has been doing well on Carrel Dakin treatment but there seems to be a pocket of pus anteriorly to be opened up soon.

November 7, 1918. Second operation. Wound completely opened up and extended.

December 5, 1918. Third operation: Opening over œdematous area below knee. Pus evacuated and several pieces of dead bone removed from a round area. Carrel Dakin treatment.

December 14, 1918. Fourth operation: Abscess opened and pus evacuated.

December 27, 1918. Wounds clean and healing slowly.

May 25, 1919. Scotch Hospital: Small wound middle of shaft of tibia. Complete fracture of same; wound not dry. ½ inch shortening.

June 26, 1919. Fifth operation: Sequestrectomy. Attempt to close cavity. Sinus excised and bone cavity

Fig. 29 (at left). Roentgenogram, Case 21, before operation.

Fig. 30. Roentgenogram, Case 21, 49 days after operation.

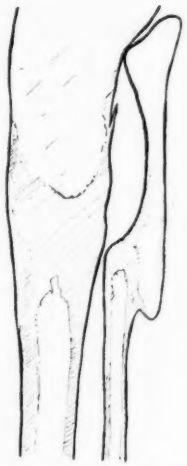


Fig. 31. Drawing showing condition in Case 22.

cleared of sequestra (2 present). Cavity scraped, incised. Pure carbolic. Soft parts sewn across.

July 10, 1919. Wound broke down rather badly—now healing nicely.

August 20, 1919. Massage. No nerve lesion. Bone union firm. Still scabbing at wounds.

September 17, 1917. Anterior tibial nerve interfered with by scar. Sinus over tibia. No bare bone felt.

November 15, 1919. Sixth operation: Excising scar down to tibia. Indolent granulations and sequestra removed from tibia and overhanging edges of bone chiseled away. Healthy bone tissue and skin apposed without tension.

November 20, 1916. Skin in poor condition, retracted from wound.

War Pensions Hospital N. C. September 1, 1920. Raw area about size of a shilling on middle of anterior surface of left leg, discharging pus. Sinus—probe goes about 1 inch into tibia.

September 2, 1920. Seventh operation: Sinus excised. Cloaca cleaned out and greatly enlarged, overhanging bone being removed with granulation tissue. Cavity opened into posterior tibial region. Cloaca "bipped." Skin sutured over and allowed partially to obliterate cavity.

September 18 1920, dressed first time. In lower two thirds of incision skin edges approximated. Upper two-thirds an elliptical gap 2 inches by 1 inch. The cavity was clean and lined with healthy granulation tissue. Packed with "bipped" gauze.

September 24, 1920, operation by Professor Morison. Old scar excised by elliptical incision 6 inches long exposing the medial portion of tibialis anticus muscle. Two counter incisions, 1½ inches away from original incision on the median and lateral aspect of the calf. These incisions were about 8 inches in length. Cavity in the bone cleaned out with spirit and "bipp." An incision made on outer surface left thigh and 4 masses of fat removed and placed in cavity in tibia to fill it up. Free medial edge of periosteum was sutured to free edge of tibialis anticus muscle by figure-of-eight suture to hold fat in position. Skin sutured with interrupted silkworm-gut sutures and the skin edges approximated with fine catgut.

Medial counter incision partially closed without tension by means of interrupted catgut sutures between the middle of the deep fascia and the medial skin edge. Two interrupted sutures also put between the two skin edges. Same procedure followed with lateral counter incision. Cavity and fat graft covered by two skin flaps attached at both ends. Skin of flaps scored. Wound dressed with "bipp," dry gauze, and boric powder.

October 15, 1920. Dressed first time—3 weeks.

Very little discharge—not more than ½ dram. Middle line wound separated at upper end about ¼ inch and fat graft was showing lying at the bottom of it. Sutures removed. Relief incisions healed except for one or two small granulating areas—about size split peas. "Re-bipped."

Incision on thigh from which fat was taken soundly healed and sutures absorbed.

October 23, 1920. Dressed. Half dram of discharge coming from fat grafted area. Fat still showing at bottom of wound and lower part of wound had given way in middle to extent of split pea showing fat there also. Dressed with flavine and castor oil.

November 20, 1920. Wound quite dry. Still two small areas in center of scar unhealed.

December 4, 1920. Wound dry. Healing—two small areas less.

March 7, 1921. Still two very small, quite dry, unhealed areas.

April 18, 1921. Healed.

June 13, 1921. Has finished radiant heat treatment. Soundly healed.

Summary. Pens. T. S., age 25. Wounded October 4, 1918. Fractured tibia. 7 previous operations. Last operation (Professor Morison) September 24, 1920—cavity filled with fat grafts. Healed April 18, 1921—6½ months.

CASE 9. Pens. B, age 23. Unhealed sinus left leg. Wounded November 10, 1918, by shrapnel. Has had 12 operations on his left leg, but it has never been healed.

At one operation 12 pieces of metal were removed—this was in June, 1919. The same month another operation was done at a Naval Hospital and a fat graft was taken from his abdomen to fill the cavity. No "bipp" was used and the fat suppurated out.

June 29, 1920. War Pension's Hospital Newcastle. Excision of sinus—large quantity of old "bipp" scraped from large cavity in tibia. Cavity cleaned out—for later operation. Patient was temporarily discharged—returned to hospital on September 27, 1920. There is still a discharging sinus below the left knee and a good deal of scar tissue round it.

October 8, 1920. Operation. Professor Morison. Tourniquet applied. Probe passed into sinus and bare bone was felt. The scar was excised by elliptical horizontal and longitudinal incisions and large cavity in the tibia, the size of a walnut, was immediately exposed. The periosteum was peeled back, and the whole surface rubbed with "bipp." The cavity was scraped out with a sharp spoon, and the infected bone chiseled away and the cloaca enlarged. The cavity was now very close to the cartilage of the joint, and about the size of a hen's egg. The bone surrounding cavity was much sclerosed. The cavity and surrounding skin were cleaned after "bipp" technique. The skin edges were undermined. Two longitudinal relief incisions, 4 inches long, were made on each side of the wound and the skin between these and the wound incisions, 2 inches wide, undermined. The whole flaps of skin between the anterior relief incision and the original incisions were turned back. An incision was made on the outer surface of the left thigh and 8 large pieces of fat were removed and placed in the cavity in the tibia. The thickened periosteum, which was peeled off the tibia, was sutured, over the fat to keep it in position. Catgut sutures and 2 interrupted catgut sutures, with figure-of-eight. The sinus flap was sutured into position over this with "bipped" silk and fishing gut. The skin edges of both relief incisions were sutured to the muscle fascia to secure as much closing as possible. Skin scored. Boric powder. Two Gooch splints. The incision on thigh was sutured with continuous suture of catgut.

October 11, 1920. There was some discharge through dressings. Pickled on outside with spirit, sprinkled with boric powder and wool dressing bandaged on.

October 29, 1920. Dressed for first time—3 weeks after operation. About one-half ounce of purulent hæmorrhagic discharge was found on dressing. The upper end of the flap had given way for three-fourths inch transversely and had separated for about one-half inch in vertical line exposing fat. The sutures were removed. Dressed with flavine and castor oil.

The wound on thigh has healed.

Bacteriological report on discharge. Large number of colonies of staphylococcus aureus found.

November 6, 1920. Second dressing. About 1 dram of pus was found on dressing. No more separation of flap. The fat remained undisturbed and in position. Dressed with flavine.

November 12, 1920. Third dressing. About 2 drams of purulent discharge were found on dressing, chiefly from tension incision wounds. Granulation tissue was a little exuberant. No fat has extruded. Cavity filled with "bipp." Granulations to be dressed daily with red wash.

November 20, 1920. Looking well. Healing. Some pus (about a dram), dressed with flavine.

November 27, 1920. Cavity healing in—to be filled with "bipp" over exposed fat.

November 29, 1920. Cavity healing in rapidly—refilled with "bipp." Granulations on relief scars now level with skin and healing well.

Fig. 32. Roentgenogram, Case 23, taken August 2, 1921, 25 days after operation.

December 21, 1920. Cavity on surface now size of a pea—no fat can now be seen.

January 19, 1921. Cavity almost filled in.

January 24, 1921. Dry crust over cavity.

January 31, 1921. Still some discharge from incision at inner side.

February 14, 1921. Almost healed. Very little discharge. (Patient has been kept in bed most of the day lately.)

February 21, 1921. Just a pin head spot remains unhealed.

February 25, 1921. Healed.

March 30, 1921. Patient sent for radiant heat treatment. All scars broke down under it. To be dressed with flavine and to be kept in bed.

Bacteriological report on discharge. Staphylococcus aureus present but not so numerous as on occasion of last examination.

April 4, 1921. Healing in rapidly. "Bipp."

April 28, 1921. Healed.

June 13, 1921. Has had radiant heat treatment again. Never broke down. Soundly healed.

Summary. Pens. B., age 23, wounded November 10, 1918, fracture of tibia. Twelve previous operations—at one fat grafts were used but no "bipp" and the fat suppurated out. Final operation for bone cavity October 8, 1920 (Professor Morison); cavity "bipped" and fat grafted. Some infection of wound but insufficient to disturb exposed fat grafts.

February 25, 1921. Healed.

March 30, 1921. Radiant heat. Scars broke down.

April 28, 1921. Healed—6 months.

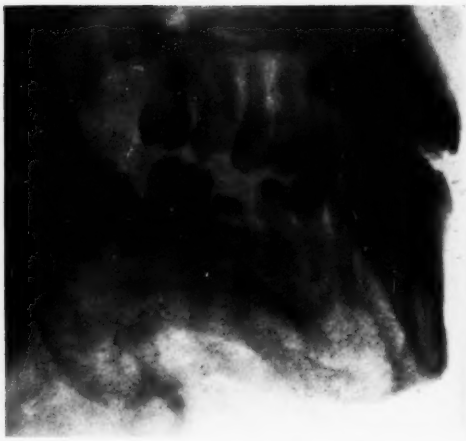


Fig. 33. Roentgenogram of jaw 6 months after fat-grafting operation.

Fig. 34. Roentgenogram of same patient as in Figure 33, 9 months after operation.

June 13, 1921. Finished radiant heat treatment. Soundly healed.

CASE 10. Pens. D., age 43. Gunshot wound right shoulder. Wounded May, 1918, near Arras. Has had three operations—the first in June, 1918, for the removal of shrapnel; the second on September 20, 1918, sequestrectomy; and the third also sequestrectomy, but he cannot remember the date. In February, 1920, the shoulder healed for the first time, but it broke down again 5 months later, May, 1920, and has been discharging since.

October 15, 1920. X-ray shows old fracture of humerus, with absence of head of bone. Healed linear scar along spine of right scapula. Healed scar on anterior surface of right deltoid region with freely discharging sinus in middle. Healed scars on lateral surface of whole upper arm; also round elbow joint on posterior medial surface. Movements of wrist and fingers impaired. Elbow ankylosed at angle of 110. Scapula movements impaired. Slight painful movement at shoulder.

October 21, 1920. Operation. Professor Morison. The sinus over the head of the humerus was excised. A large cavity was found in the ankylosed head of the humerus. The cavity extended a considerable distance down the shaft and upward underneath the clavicle to the scar on the back of the scapula. A large amount of dense fibrous tissue was removed also overhanging the bone edges. Pus was found to be issuing from the cavity in the bone, which tracked through scapula into supraspinous fossa. This cavity was cleared and the whole wound treated with "bipp" technique. A square-shaped skin flap was reflected over the deltoid. Two large flaps of deltoid muscle were detached from the humerus at its insertion; the inner flap was turned up into upper cavity and the second down into lower cavity. These were "bipped" and sutured with numerous catgut sutures into the cavity which was completely obliterated. The skin was sutured with interrupted "bipped" silk, "bipped" and dressed with dry gauze impregnated with sterile boric powder. A large woollen pad was put in the axilla, and arm bandaged to side.

October 28, 1920. Patient has a strong smell of iodoform. There is a faint blue line round teeth—"bipp" poisoning.

November 12, 1920. Dressed first time—3 weeks after operation. The transverse portion of the wound has healed. In the middle of the vertical portion is an area the size of a split pea, which is not healed. "Bipped." At upper end over a thin scar were 3 very small granulating areas. "Bipped." No discharge was found on dressings—a little paraffin had been exuded from the "bipp" which was quite dry. Boric powder. Dry gauze. Arm put up against side as before.

March 7, 1920. Not quite healed—a very little discharge.

April 4, 1921. A probe dipped in pure carbolic acid was passed right through both sinuses. No bone was felt. Track to be squirted through with Beck's paste.

July 4, 1921. The two sinuses still communicate. To be washed through with peroxide.

Summary. Pens. D., age 43, wounded May, 1918. Large bone cavity in upper end of ankylosed humerus, cured by muscle grafts. The case is shown specially to illustrate the difficulty of treating shoulder wounds, and partly because this patient is the only one we have had here showing "bipp" poisoning in the first degree. Operated upon October 21, 1920.

October 28, 1920, "bipp" absorption. Not at all ill, but blue line round teeth.

April 28, 1921. Sinuses are still present in soft parts but bone cavity healed long ago.

July 4, 1921. Sinuses not yet healed.

CASE 11. Pens. B., age 43. Gunshot wound right knee. Wounded June 2, 1915, at Ypres. Patient has had 5 operations. At one of these fat grafts were employed but no "bipp" was used and they suppurated out.

On admission, September 2, 1920, sinus was present in upper end of tibia below insertion of ligamentum patellæ and reaches bone.

September 3, 1920. Acute lymphangitis of thigh developed and operation was therefore postponed.

September 8, 1920. Acute abscess incised on antero-internal surface of the middle of the right thigh. About 2 ounces of thick pus evacuated.

September 22, 1920. Radiant heat was applied to right leg.

September 25, 1920. Bacteriological report on pus from bone cavity: Diphtheroid bacillus present, resembling in microscopic staining and cultural aspect the diphtheria bacillus but *non-pathogenic*.

October 11, 1920. Bacteriological report. A few diphtheroid bacilli present still. Large number of staphylococci found.

November 2, 1920. Operation. Professor Morison. Tourniquet applied. A semilunar incision with convexity lying medially was made. The sinus was excised and the whole wound treated with "bipp" technique. The cloaca was enlarged and very vascular bone removed, also two metallic bodies. Tourniquet removed. "Bipp." Cavity filled with 5 large and 2 small pieces of fat taken from the left thigh. Wound completely closed with interrupted silkworm-gut sutures. "Bipp." Skin scored. The wound was dressed with dry gauze and boric powder. No splint was applied. The incision on the left thigh was sutured with silkworm gut.

Bacteriological report on discharge (taken before commencement of operation): diphtheroid bacilli still present, streptococcus and staphylococci also found.

November 23, 1920. Dressed for first time after operation—3 weeks. Skin flap has partially sloughed, exposing a circular area over the cavity, about the size of a shilling piece. Fat exposed. No clinical evidence of infection. Very little discharge. The lower part of wound has healed. Dressed with flavine.

November 29, 1920. Thigh (from which fat grafts were taken) has healed. Fat in cavity still exposed. Healing in from edges. No pus.

December 12, 1920. Under local anæsthesia, an incision 2½ inches long, curved on the inner side of the sinus, was cut down to the tibia, with a view to increasing the blood supply to a proposed flap that was to be cut for covering over the exposed fat.

December 20, 1920. Operation. Flap cut with pedicle above and drawn over the exposed fat and sutured in position. Tension incisions were made and the exposed area brought together as closely as possible with catgut sutures.

December 27, 1920. Patient thought the bandage had slipped, so dressing was changed. The flap had given a little at the upper end—an area the size of a little finger nail. The whole flap was living and looking well. "Re-bipped."

January 10, 1921. Wound is being dressed every second day. There is little discharge. Wound is granulating satisfactorily. To be dressed once a week.

January 31, 1921. Still a little serum (one drop) at upper and outer angle of flap. "Bipp." To be allowed up on crutches.

February 7, 1921. There is still a very little serum on the dressing.

March 14, 1921. Wound very nearly healed.

June 13, 1921. Wound not healed yet. Nothing could be felt with probe. To be probed when dressed (once weekly) with pure carbolic.

July 18, 1921. Wound not yet healed. Very little discharge.

Summary. Pens. B., age 43. Wounded June 2, 1915. Fractured tibia. Six operations since. Fat graft used at one of them but no "bipp" and fat suppurated out. Final operation for bone cavity November 2, 1920 (Professor Morison). Skin flap partially sloughed exposing fat. Still not quite healed. Area of dermatitis. This man's skin intolerant of iodoform or flavine.

Case 12. Pens. C., age 29. Gunshot wound of right thigh. Wounded April 6, 1918, by shrapnel. The right femur was fractured and in consequence there is 2-inch shortening of that bone. The bullet passed right through the thigh and since that date the anterior (entrance) wound has never been sound—occasionally healing for a few weeks and then breaking down and discharging copiously for a prolonged period. He has undergone 8 operations—the most recent in September, 1919. Owing to an accident the damaged bone was refractured last year but united without much trouble.

Fig. 35 (at left). Photograph of Case 24, 1 year and 5 months after operation.

Fig. 36. Roentgenogram, Case 24, 1 year and 5 months after operation.

On admission, November 1, 1920, there was a discharging sinus on the front of the right thigh, extending downward and backward to bone, admitting probe for 3 inches. The posterior wound was healed.

November 15, 1920. Operation. Professor Morison. A probe was passed into the sinus and bone felt. The sinus was excised with elliptical incision, 6 inches long. The periosteum was peeled back, and a cavity, the size of a walnut, exposed. It was cleaned with spirit. "Bipped." The edges of the cavity were chiseled away—it was endeavored to broaden out the hole in order to make as shallow a gutter as possible. It was impossible to use a tourniquet as the lesion was so high up on the thigh. The hæmorrhage was arrested by hot saline mops and Lane's clips. The whole surface was again cleaned, spirit and "bipped." A perforation at the base of the cavity, extending through to the back of the thigh, was plugged with fat. A muscle and scar pedicled flap was sutured down to fill the cavity. The vasti muscles were sutured over this with figure-of-eight suture of thick catgut. The skin was closed with "bipped" silk suture. No splints were applied.

December 10, 1920. Dressed—first time—3 weeks. All healed except one small granulating area in center of the wound, the size of a split pea. The sutures at middle and lower end had cut in a little. The sutures were removed. "Bipp." Boric powder.

Bacteriological report. Staphylococcus present in specimen.

January 6, 1921. Returned from Christmas leave. Unhealed superficial small area in center of scar still discharging slightly. Flavine.

January 31, 1921. One drop of discharge. The granulating area is now the size of a pin head.

February 14, 1921. Still an unhealed area present in center of scar. To have radiant heat through his dressings, but to report at once if the wound "flares up."

March 14, 1921. Still one very small superficial discharging area in scar.

April 18, 1921. Healed.

April 28, 1921. Wound has broken down again. Probed with pure carbolic—no bare bone felt.

June 13, 1921. Wound heals and breaks down alternately. Probe passed down very small track in soft parts. No bone felt.

July 18, 1921. Still a small sinus, which is filling in from the bottom.

Summary. Pens. C., age 29, wounded April 16, 1918. Fractured femur. Eight previous operations. Final operation for bone cavity. November 15, 1920. Professor Morison. The wound has alternately healed and broken down again. Was healed on April 18, 1921, but broke down superficially 8 days later. No bare bone can be felt.

CASE 13. Pens. McB., age 33. Gunshot wound left thigh. Wounded December 8, 1916, by a bullet in the left thigh, the femur being fractured. The anterior and posterior wounds have alternately healed and broken down, but have never both been sound at the same time. He has had 12 operations—the most recent in March, 1920.

On admission, November 1, 1920, there was no shortening and the bone was united in good position. The wound was a through-and-through one, with the exit on the posterior aspect of the limb. There was a small depressed ulceration in the middle of the thigh from the center of which a sinus passed directly backward to the femur, which felt as though it were stripped of periosteum, but no cavity or sequestrum was palpable.

November 19, 1920. Bacteriological report on pus from wound *before* operation: Gram negative bacilli present. Bacillus coli. No staphylococcus nor streptococcus found.

November 19, 1920. Operation. Professor Morison. The cavity in the femur was exposed and enlarged. A small perforation passing backward through the bone was enlarged and 3 sequestra removed. The cavity where the sequestra were lying was excavated and the bony opening into it enlarged. This was cleaned out with spirit and the whole "bipped." Four small fat grafts were placed in the posterior cavity and a pedicled flap of quadriceps was turned down to fill the larger part and sutured into position. The wound was sutured with catgut. To be dressed in 3 weeks.

December 10, 1920. Dressed first time—21 days. Two apparently superficial granulating areas (the size of split pea), were present between the sutures at the junction of middle and lower thirds of wound. There was no discharge from either of these and a layer of "bipp" was seen lying all along the wound. "Bipp" dressing. The incision from which the fat was taken was all healed except that the second stitch at the upper end had cut in slightly. "Bipp."

January 6, 1921. Returned from Christmas leave. Soundly healed. For radiant heat.

January 24, 1921. Finished radiant heat treatment. Soundly healed. For discharge.

Summary. Wounded December 8, 1916. Fractured femur. Twelve previous operations. Last operation November 19, 1920. Professor Morison.

January 6, 1921, returned from Christmas leave all healed—7 weeks and 5 days.

CASE 14. Officer, age 24. Gunshot wound right arm. Wounded April 9, 1917. The arm was healed from April, 1919, until July, 1920. Before that it had alternately healed and broken down—never healed for more than 3 weeks at a time. In June, 1920, the arm ached and swelled and an acute abscess formed. He has had 8 operations.

July 8, 1920. X-ray shows old fracture humerus—possible cavity.

November 19, 1920. Operation. Professor Morison. A discharging sinus over upper end of humerus was excised. The upper end of the humerus was exposed. There was a sinus communicating with the medullary canal. The sclerosed anterior wall of the bone was removed for a considerable distance exposing a large cavity. A long strip of the anterior edge of the deltoid muscle was detached from its insertion and curved up and sutured into the upper cavity, being retained in position by several catgut sutures. A second flap of deltoid was turned down into the lower cavity and sutured there. The whole surface was treated with "Bipp" technique. Interrupted silkworm-gut and catgut sutures were used for the skin. The arm was bandaged to the side. The patient, who lost a considerable amount of blood (it was impossible to apply a tourniquet), was given 1 pint of coffee and 1 ounce of sugar per rectum.

November 23, 1920. Patient feeling very comfortable. Temperature normal. Color good.

December 10, 1920. Dressed first time since operation—3 weeks.

About ½ dram of moisture on dressing (apparently paraffin and "bipp"). One of the sutures at about the middle of the wound had cut in a little. The sutures were removed. One small granulating area was present at bottom of wound—rest healed. "Bipp." For daily dressing.

December 14, 1920. Healed. To be allowed home for holidays and to return (if all is well) on January 5, for 10 days' radiant heat treatment.

January 5, 1921. Returned soundly healed. For radiant heat.

January 14, 1921. Finished radiant heat treatment. Wound has *not* broken down. Being discharged tomorrow.

Summary. Lieut. H., age 24, wounded April 9, 1917. Fractured humerus. Eight previous operations.

Last operation November 9, 1920. Professor Morison. A cavity in the upper end of the humerus was filled with muscle graft from the deltoid. Healed December 14, 1920—25 days.

CASE 15. Officer A., age 26. Gunshot wound left thigh. Wounded August 13, 1918, by a machine-gun bullet, when flying. The wound healed several times, but broke down again each time, never remaining healed for longer than 3 weeks at a stretch. He has had 10 operations.

November 23, 1920. Admitted to War Pensions Hospital, with very small sinus at center of external surface of left thigh.

November 26, 1920. Operation. A curved incision 8 inches long, excising sinus, was made. The fibrous tissue was excised, the bone exposed, and the periosteum peeled off. A small sequestrum found lying in cavity on posterior surface of bone was removed. The whole area treated with "bipp" technique. The cavity was filled with small fat grafts. The deeper tissues were sutured with interrupted figure-of-eight catgut sutures—also controlling some hæmorrhage from fibrous scar tissue. The incision wound was sutured without tension with interrupted silkworm-gut sutures.

December 18, 1920. First dressing—3 weeks after operation.

The dressing was perfectly dry except for one spot of granulation tissue, about the size of a split pea. This area was in the center of the wound. The whole of the rest of the operation incision was healed by first intention.

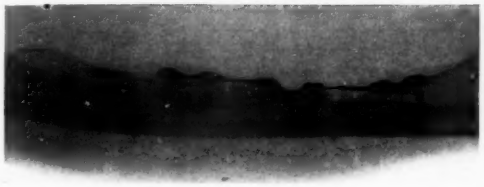
December 20, 1920. Healed.

January 20, 1921. Has had radiant heat treatment for 3 weeks and remains soundly healed.

37

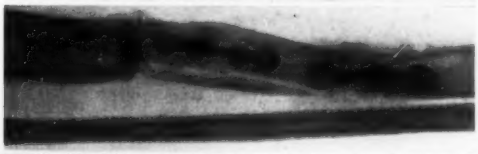
38

39

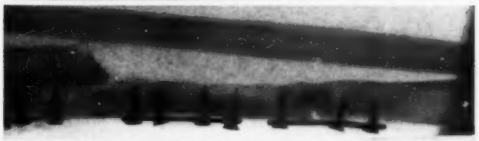


40

41



42



43

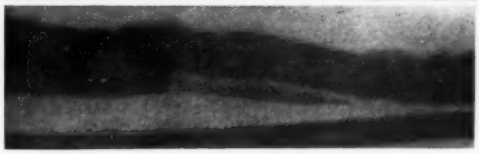


Fig. 37. Drawing showing condition in Case 25 before bone-grafting operation.

Fig. 38. Roentgenogram, Case 25, 16 months after plating operation.

Fig. 39. Case 26, 79 days after operation.

Fig. 40. Roentgenogram, Case 27, showing condition before Professor Morison's operation.

Fig. 41. Roentgenogram, Case 27, 139 days after operation.

Fig. 42. Roentgenogram, Case 27, 139 days after operation.

Fig. 43. Roentgenogram, Case 27, 6 months after operation.

Summary. Capt. A., age 26, wounded August 13, 1918. Fractured femur. Ten operations have been done since and have failed to secure healing of sinus in thigh.

November 26, 1920. Operation for bone cavity. Fat grafts. Professor Morison.

December 20, 1920. Wound entirely healed—24 days.

CASE 16. Pens. M., age 28. Gunshot wound right knee. Wounded July 1, 1916, on the Somme. Three operations before admission.

February 27, 1920. A depressed scar is adherent to the bone over the external condyle of the femur. The knee is ankylosed at an angle of 150°.

April 4, 1920. Fourth operation. A cuneiform wedge was taken out of the lower end of the femur and the upper end of the tibia. Infection followed the operation.

November 8, 1920. Admitted to Ward 3. Three discharging sinuses were present in the incision line on the inner side of the joint.

November 12, 1920. Fifth operation. The old wound had been opened up over the sinuses and two small sequestra were removed.

February 1, 1920. Still discharging sinuses were present — never healed since last operation.

February 3, 1921. Sixth operation. Professor Morison. A cruciate incision and the site of ankylosis explored. Four small cavities were exposed—gouged out and cleaned, "bipp" technique. Several small sequestra were removed. The cavity was filled with pedicled flaps of fat from the under surface of the skin flaps. Spirit. "Bipp." Wounds closed.

February 10, 1921. Discharge had been through dressing 3 times and dressings very wet, so taken down. Still oozing a little at lower end of wound. The rest of the wound was apparently dry and covered with "bipp." "Re-bipped."

February 14, 1921. No more discharge through dressing.

February 27, 1921. Soundly healed. Sutures removed.

March 7, 1921. To wear a plaster bandage on knee.

Summary. Wounded July 1, 1916, in knee (right). Five operations previous to fat grafting. Last operation February 3, 1921 (Professor Morison). Healed February 27, 1921—24 days.

CASE 17. Pens. B., age 28. Gunshot wound of right femur. Wounded by an explosive bullet in the right thigh on September 26, 1915. The femur was fractured. He was treated on a Thomas splint for 6 months. Since that date he had never been absolutely healed, there had always been a discharge from a sinus. There had been numerous acute "flares" and abscesses had been incised in different places. Many pieces of bone had come out through the sinuses. Fifteen previous operations.

On admission to this hospital on January 14, 1921, there was a discharging sinus on the outer side of the right thigh, at the junction of the middle and upper thirds. It led down to a cavity in the bone. There was considerable discharge.

February 9, 1921. Operation. Mr. Irwin. The old scar and sinus were excised. The cavity was opened up, and the sides gouged out. The cavity was scraped and

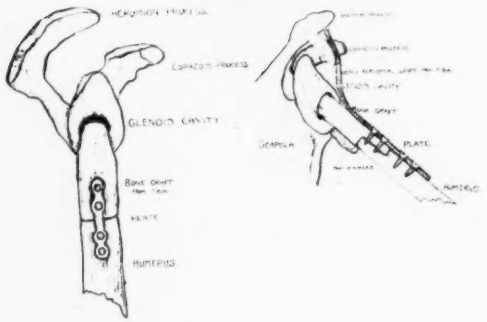


Fig. 44 (at left). Diagram of fixation of shoulder operation with bone graft of humerus. Case 28.

Fig. 45. Diagram of fixation of shoulder operation with bone graft of humerus. Case 28.

cleaned out with spirit and "bipp." The knee joint being stiff, a pedicled muscle flap was cut from the vastus externus and turned into the bone cavity. The skin and muscle were approximated with catgut.

March 2, 1921. Dressed first time. Quite dry and healed by first intention.

Case 18. Pens. H., age 28. Gunshot wound right arm. Compound fracture. Wounded December 20, 1915, by a sniper's bullet—range about 300 yards. Has had 16 operations. Arm has never healed.

On admission, March 15, 1921. Healed scars over upper part of right humerus. Small discharging sinus beneath. Multiple drainage scars on front and back of arm. Operation scar on posterior aspect of arm, partially healed. Two discharging sinuses at upper part of arm.

X-ray shows evidence of fracture of humerus; much callus formation with opening into bone and evidence of necrotic fragment present.

April 1, 1921. Operation. Professor Morison. Anterior scar and sinuses excised by long elliptical incision. Upper end of humerus exposed by separation of deltoid from pectoralis major. A large cavity, 3 inches long, in bone opened up by chiseling through anterior bony wall. The posterior sinus opened into it. A sequestrum, 1¾ inches long, was removed. The cavity and posterior sinus were "bipped," and filled with fat. The wound was entirely closed by fishing gut mattress sutures in center and catgut for edges of wound throughout. Dressed with arm bandaged to chest.

April 4, 1921. Discharge had been through dressings twice, so taken down; looking excellent—a little discharge from back wound—no pus.

April 16, 1921. Quite dry and entirely healed.

Summary. Pens. H., age 28. Wounded December 20, 1915. Fractured humerus. Sixteen operations on arm—never healed. Last operation April 1, 1921. Professor Morison. Healed April 18, 1921—17 days.

Case 19. Pens. J. T. S., age 35. Gunshot wound left thigh. Wounded by shrapnel in the left thigh on September 25, 1916. Has had 12 operations. He was once healed for 6 months after an operation a year ago. Wound has now been broken down for 3 weeks.

On admission March 30, 1921. Large scar 5 inches long, is present on outer side of thigh opposite external intermuscular septum, with 2 sinuses, each about the size of a horse bean, near the center, extending down to bone. X-ray shows cavity in femur.

Fig. 46 (at left). Roentgenogram, Case 28, before operation.

Fig. 47. Roentgenogram, Case 28, 94 days after operation.

April 4, 1921. Operation. Professor Morison. The sinus was probed. The instrument passed through a narrow opening on the outer side of the bone into a cavity the size of a bantam's egg. The walls were dense and sclerosed and lined by a thick layer of fibrosed granulation tissue. The cavity was opened up by chiseling away the wall on the outer side. No sequestra were found. There was a lot of scar tissue, fibrous in consistency, lining the cavity. This was scraped and gouged away and when the entire area was exposed spirit was run in, followed by "bipp." Six pieces of fat were then taken from the subcutaneous tissue of the other thigh and packed into the cavity. The muscles were approximated with catgut sutures, the skin with silkworm gut. A small amount of "bipp" was rubbed over incision; dry dressings; boric powder.

April 18, 1921. Dressed first time. Quite dry. The stay sutures were removed. There was a little hæmorrhage from the top suture hole when removed. Otherwise all healed.

Bacteriological report on hæmorrhagic discharge: A few colonies of staphylococci.

May 2, 1921. Still a very little discharge.

May 13, 1921. Healed.

Summary. Pens. J. T. S., age 35. Wounded September 25, 1916. Fractured femur. Twelve previous operations. April 4, 1921. Last operation for bone cavity (Professor Morison). May 13, healed—39 days.

Case 20. Pens. L., age 23. Wounded by machine-gun bullet in the left thigh on October 26, 1917. The bone was broken. He was treated on a Thomas splint for 4 or 5 months, and during that period he was operated upon 3 times. The wound then healed and he was put up in plaster of Paris for 4 months. The wound was open when this was removed. He has had 16 operations, last one 12 months ago. Wound has never remained healed more than a day or two.

On admission, April 4, 1921. There is now a discharging sinus at the bottom of a depressed cicatrix on the outer side of the left thigh, the sinus passing down to the femur in which there is a cavity.

April 8, 1921. Operation. Professor Morison. The sinus was probed. The probe passed down to the outer side

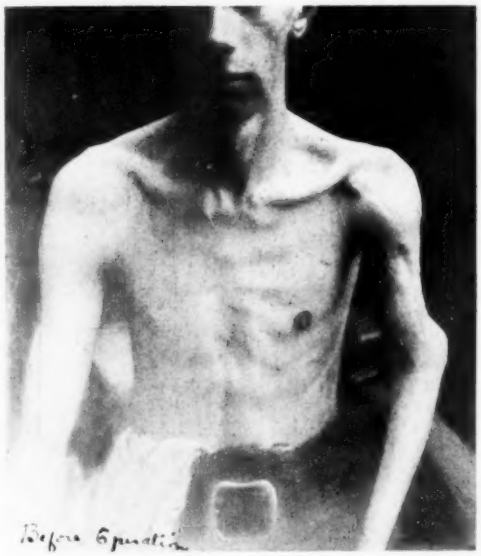


Fig. 48. Photograph of patient before operation. Case 29.

Fig. 49 (at left). Roentgenogram, Case 29, before operation.

Fig. 50. Roentgenogram of arm, Case 29, 85 days after operation.

the femur, which was felt to be bare. A 6-inch incision was made down to bone. Four large sequestra were felt and removed from a cavity deep on the inner and posterior part of the bone lined with soft septic granulations. These were taken away and the area cleaned, "bipp" technique. A separate incision was then made on the outer side of the same thigh and fat taken out. Six small pieces were introduced into the prepared area. The muscles were drawn across with catgut and the skin edges approximated with silkworm-gut, entirely closing the wound.

April 18, 1921. Dressed first time—10 days. Quite dry and apparently healed.

April 24, 1921. Sutures removed. A little serous discharge from center of wound.

April 28, 1921. Not quite healed in center of wound.

May 2, 1921. Quite dry and healed.

Summary. Pens. L., age 23. Wounded October 26, 1917. Fractured femur. Sixteen previous operations. April 8, 1921. Last operation for bone cavity. Professor Morison, April 18, 1921. Healed—10 days. Some serum escaped since sutures were removed. May 2, 1921. Soundly healed—24 days.

CASE 21. Pens. D., age 25. Gunshot wound of right thigh. Wounded September 18, 1916. Fractured femur. Persistent sinus following gunshot wound on front of thigh. The wound has healed periodically—never for more than 5 weeks at a time, and when healed the leg was always painful and swollen. Seven previous operations. One and one-half inches shortening of leg.

X-ray shows shadow—? sequestrum,—and cavity in much thickened femur.

April 29, 1921. Operation. Professor Morison. Bone cavity opened up from front. A sinus was found to pass down through the cavity of the femur to the posterior aspect of that bone. A second incision was made at right angles to the lower end of first. The vastus externus was divided and the femur fully exposed. A sequestrum was felt near the back of the bone. After considerable trouble it was removed, by manipulation through the back and front, from the anterior sinus. The sclerosed bone was chiseled out of cavity as much as possible. Eight fat grafts were transplanted from the opposite thigh into the cavity, after "bipp" technique. The vastus externus was sutured with mattress sutures of catgut. The skin was sutured with silkworm-gut. "Bipp" dressing. No plaster.

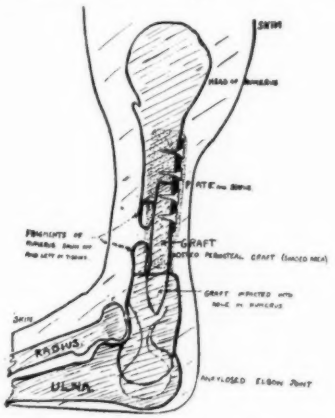


Fig. 51. Diagram of bone graft of humerus, Case 29.

Fig. 52. Roentgenogram, Case 30, before operation, May 15, 1920. Showing irregular upper fragment; lower fragment squared off.

Fig. 53. Roentgenogram, Case 30, January 4, 1921, before Professor Morison's operation.

Fig. 55. Roentgenogram, Case 30, 79 days after operation. April 24, 1921.

May 2, 1921. Dressed for first time on account of hæmorrhage through the dressings twice during night, and because patient had a temperature of 101.4° last night. Dressing all stuck tight by hæmorrhagic effusion. Wound looked perfect—free from any signs of inflammation. All stitches were in healthy condition.

June 13, 1921. Still a small (pea-sized) area unhealed at lower end of scar. Small loose piece of bone felt in this sinus 3 days ago?—could not be removed with forceps.

June 20, 1921. Back wound healed. Front wound as before—no bone felt.

July 18, 1921. Almost healed. No bone felt.

Summary. Pens. D., age 25, wounded September 18, 1916, in right thigh. Fractured femur. Persistent sinus—wound healed periodically, but never remained healed for more than 5 weeks at a time. Seven previous operations. Last operation April 29, 1921, Professor Morison. Sequestrum removed, cavity treated "bipp" technique and filled with fat grafts. Dressed first time May 2, 1921. The wound looked perfect and was free from any inflammation.

June 10, 1921. Small piece of loose bone felt in sinus—could not be removed.

July 18, 1921. Very small sinus. No bone felt.

CASE 22. Pens. H. Gunshot wound of left leg. Wounded by shrapnel bullet in left leg on April 23, 1917. The tibia was fractured. The longest period that the wound has been healed since discharge was 3 months. He has had 11 operations, efforts to heal the wound.

May 12, 1921. Operation. Mr. Irwin. A longitudinal incision was made over the sinus. The cavity was exposed. No sequestra were found. Granulations were scraped out. The sclerosed bone was chipped away. A fat and muscle graft was swung from outer side of gastrocnemius. "Bipped." The wound closed with "bipped" silk.

May 21, 1921. Dressed. No pus discharge—small granulating surface about center of scar.

June 9, 1921. The wound was entirely healed and firm (4 weeks after operation). No sloughing of skin flaps. No exposure of muscle and fat flaps.

July 8, 1921. Having radiant heat treatment.

Summary. Pens. H. Gunshot wound of left leg. Wounded April 23, 1917. Fractured tibia. Never healed for more than 3 months. Eleven previous operations. Last operation May 12, 1921, Mr. Irwin. Cavity cleaned with "bipp" technique. Fat and muscle grafts.

May 21, 1921. Dressed. One small granulating surface center of scar. June 9, 1921. Wound entirely dry and healed (4 weeks after operation).

CASE 23. Pens. C., age 26, wounded November 17, 1917. Fractured humerus. Six previous operations. Never healed.

On admission, July 4, 1921, a large scar was present over the anterior portion of the upper third of the upper arm, with a sinus in the center discharging pus; also scar on back of arm, same level.

July 8, 1921. Operation. Professor Morison. The greater part of the scar and sinus were excised by an

elliptical incision. The periosteum was peeled off and the bone sinus exposed, probed, and found to extend up and down the bone for a considerable distance. The cavity was exposed by chiseling the superficial bone away. The anterior wall of the cavity was chipped away for about 4 inches. It consisted of very sclerosed bone. Five large sequestra and 2 smaller ones removed. The sequestra were lying in the posterior wall of the cavity, and the upper one posteriorly reached the scar at the back of the upper arm. The sequestra were so long that eventually a cavity of about 5 inches in length was left in the humerus, without any anterior wall. The upper and deeper end of the cavity was filled with six fat grafts taken from the fat overlying the deltoid. The remainder of the cavity was filled with a long strip, detached from below up, of the anterior portion of the deltoid muscle. The tongue of the deltoid was sutured with catgut into the lower end of the cavity, and the remainder of the deltoid flap was buried in the cavity by a figure-of-eight catgut suture over it. The incision was completely closed with fishing gut. The skin over the deltoid, outer flap, and remainder of scar were scored. "Bipp." Dry gauze. Boric powder. Arm put up against chest.

July 14, 1921. Dressed first time—6 days. One small granulating area, size of a little finger nail, at lower end of incision wound. Rest of wound healed.

July 27, 1921. Soundly healed.

Summary. Pens. C., age 26, wounded November 17, 1917. Fractured humerus. Six previous operations. Never healed. Last operation July 8, 1921. Professor Morison. Cavity cleaned after "bipp" technique and filled with fat grafts and a long strip of the deltoid. July 14, 1921. Dressed first time. All healed except one small area the size of little finger nail, at bottom of incision wound. July 27, 1921. Soundly healed.

As the cases show it is possible to obtain healing of these septic cavities by "first intention" and, though some of them may take a long time, failure, as I have proved, is an infrequent event. In my experience the greatest obstacle to prompt recovery is the difficulty of securing a healthy skin covering for these fat-filled cavities. Skin flaps are apt to slough, and skin edges united immediately over the packing are apt to separate and expose the underlying fat. In spite of this exposure the fat if protected is not extruded, but after a long time becomes vascularized, the granulations which develop on it join those of the wound edges, and healing occurs with a very small linear depression—not at all resembling an ordinary bone cicatrix. I have watched with great interest this happening in many cases which I have had the opportunity of observing for weeks, until healing had at last followed. Scoring flaps is sometimes sufficient to prevent death of them, from arrest of circulation by œdema, and this should always be done. In doubtful cases, such as those with multiple cavities, or those in which it is difficult to see to the bottom, operation in two stages is an advance on our earlier methods, and we have recently adopted it when skin flaps are necessary to cover the cavities, especially in such

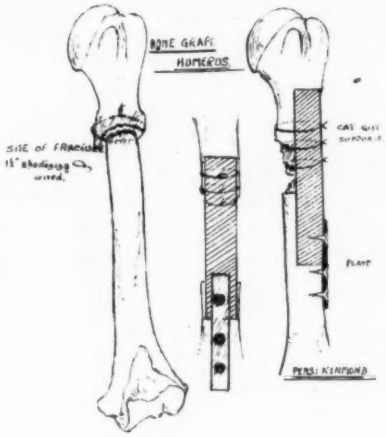


Fig. 54. Diagram of operation in Case 30.

positions as in the head of the tibia, which are specially difficult. In these instances, after preparing the cavity, we outline the skin flap by a deep incision all round, except at the side to be left as a future pedicle. By this means, we hope that in 3 weeks the circulation through the pedicle, increased by cutting off the blood supply from other directions, will suffice to nourish the flap, but our experience with this method is still insufficient to allow of confident statements.

In civilian practice this method of treating bone cavities is applicable to the slowly healing results of bone infection and necrosis. I have also used it in the case of a girl from whose lower jaw I had scooped out a myeloid tumor the size of a large orange (Figs. 33 and 34). The big wound healed after 12 months but left a large deforming depressed cicatrix adherent to the cupshaped cavity previously occupied by the tumor. After dissecting away the cicatrix and removing some of the superfluous bone I filled the cavity with fat grafts, and by undermining the surrounding skin, left them covered with flaps which united by first intention in a fortnight, leaving a linear cicatrix without any depression. The soft fat underlying the scar, easily palpated, became gradually harder until now, a year after the operation, the old cavity is filled with bone, though it is not yet entirely dense to X-rays.

The only addition I have made to the methods described in the "bipp" book is that now the skin around the wound is dusted with sterile boracic powder before the wound is dressed. It is also not always wise to aim at the surgical triumph of a wound healed under a single dressing

left untouched for 3 weeks. Blood escaping into the dressing makes it moist, and especially when old scars are present these are apt to break down and produce raw septic areas, which interfere with primary healing. A second dressing performed at once with gauze wrung out of spirit may save the situation, and it is preferable to the "pickling" which we found so serviceable in the earlier and more strenuous days during the War. If the wound is at all moist, dressings should be changed daily until it is dry.

Bone Grafting

The first patient I am exhibiting shows the result of a failure in technique. Five weeks after the operation when his arm was dressed, because of discharge through the dressings, it was found that the wound had broken down at the upper end and the arm and the leg from which the graft was taken were both suppurating.

What is the explanation?

This patient was the first upon whom I had operated in an entirely new environment—new assistants, new nurses, and new surroundings over which I could exercise little control. While the graft was being removed from the tibia I noticed with sudden surprise that the flow of saline used to cool the Albee saw was splashing from it into my chief assistant's face, and was running in a stream off his nose on to the tibia from which the graft was being taken. This was, of course stopped at once, and the operation was not proceeded with until the sawn tibia had been drenched with saline. There cannot be any doubt that infection of the graft was caused by this mishap, for both arm and leg suppurated. This experience is a gross one but it teaches the need for a trained team, accustomed to work together, for this purpose.

It seems as if the technique necessary to ensure good results must be better in this class of surgery than in any other, because the operation, however carefully done, must cause serious trauma, considerable damage to the surrounding tissues is inevitable, and tissue resistance is still our most powerful antiseptic. It is also certain that if plates, of which I am going to say something later, are used, the danger of infection is increased.

In all the literature referring to bone grafting after war wounds, the danger of infection—latent infection—is emphasized. It is advised that months should elapse after the wound is healed before any such operation is undertaken. Early in the War A. E. Morison, of Sunderland, informed me that he had found radiant heat the best test for healed wounds of the extremities, and I gave orders that patients should be treated by this means at the Northumberland War Hospital. Ten per cent broke down under the influence of radiant heat. Since then all our cases are subjected to a preliminary 10 days of treatment of their scars by radiant heat. If the result of this is negative, and if after operation any infection should develop, we blame, not the patient, but his surgeon.

In bone grafting I still perform all manipulations with instruments only, as an additional safeguard against infection of the wound, though no wound with our present methods is absolutely safe. Perfection in wound technique has not yet been attained. Any doubt as to the truth of this statement has been settled by Dr. Laws, who has had cultures made from our operating theaters during operations. These prove that organisms are constantly dropping into our wounds from the air, and though, judging by results, very few of them manage to do harm it cannot be that they are *all* non-pathogenic as so many surgeons teach.

There are still many problems awaiting solution in connection with bone grafting, but I have only time now to consider one of them.

Fixation of the graft by metal plates has been decried by surgeons as a complete failure. I am going to ask you to keep an open mind still, in the light of my experience, because I have continued, in spite of surgical agreement to the contrary, to use metal plates for special cases. In the humerus and in the femur I do not think any method of fixation can equal the metal plate, if the bone is firm enough to hold screws. If it were true that a plate prevented osteogenesis so that the graft could not unite, plates would, of course, be taboo. But it is not true, and my cases prove it. In the first case exhibited the plates on both ends of the graft were taken off in 5 weeks. The lower end of the humerus was already firmly united to the graft. Ordinarily the ingenious methods of Albee leave little room for competition, and we are all his debtors for the work and excellent outfit he has elaborated, but some of his conclusions need modification. When a plate is used for a superficial bone, or in the neighborhood of old scars, it is best to remove it when it has served its purpose; if the plate is buried under muscle, as it generally can be in the case of the humerus and femur, unless it causes trouble it is best left alone. One of the soldiers admitted to the Northumberland War Hospital under my care had had his femur plated by the late Professor Sinclair White, of Sheffield, 15 years earlier. He had been in the thickest of the fighting for a year, was football expert in civil life, had never had any trouble after

his recovery from the fracture, and X-ray showed the plate to be as firmly fixed as it could have been when it was first put on. I started surgery with a prejudice against plates or any other unabsorbable foreign bodies, but now know that both are sometimes good. There is just one caution as to their use. They are dangerous for surgeons who cannot feel confident that wound infection will not follow their operations.

Experience at the Northumberland War Hospital has taught me that, when bones are shortened by loss of portions of them, if the broken ends are brought together and held there, union seldom occurs. My explanation is that the stimulus of contracting muscle is lacking in these cases and that this inhibits osteogenesis. I do not know whether the explanation is correct or not, but there can be no doubt as to the difficulty of obtaining union. If this view of mine is correct the step graft method is a bad one.

The cases exhibited emphasize these points, and may elicit others for discussion.

CASE 24. Pens. C., age 30. Gunshot wound right shoulder. Wounded April 14, 1918, in France. He has had 4 previous operations. The bone has never united.

On admission we found entry wound at junction of upper and middle thirds, on anterior aspect of right humerus. Exit posteriorly. No nerve lesion. Humerus shattered, fully 3 inches being blown away.

November 17, 1919. Operation. Professor Morison. Tibial bone graft and plating. One plate attaching graft to humerus above, and another to humerus below. The upper fragment of the humerus was so soft that the plate was tied on to it with thick catgut, no screws being possible.

December 28, 1919. Dressed first time—5 weeks. The wound had opened up and was infected, and the upper half of the bone graft was uncovered. Firm union had taken place in the lower end of the graft; the upper end was free and projecting through the wound with plate attached. Both plates were removed.

November 30, 1920. There is an extensive open wound over the anterior aspect of the upper end of the right humerus. A bit of bone, 2½ inches long by 1 inch wide is seen. Granulation is taking place in new tissue which is healthy. The condition, though unhealed, is satisfactory, and it is expected that the exposed bone will shortly sequestrate. Thick new bone firmly attached above and below. Head of humerus rotates freely with new shaft.

Summary. Pens. C., age 30, wounded April 14, 1918. Four previous operations. Gap in humerus. Operation—bone graft—November 17, 1919. Professor Morison. Dressed December 28, 1919. Wound opened up. Graft exposed. Union lower end of graft. Upper end free. November 30, 1920. Graft still exposed, but union firm. Humerus reproduced.

CASE 25. Pens. P., age 24. Gunshot wound left forearm. Both bones fractured. Wounded October 27, 1918.

January 1919. On the ulnar border of the left forearm, about center, there is a scar 2 inches by 1 inch; on flexor surface, a scar, 3 inches by 1 inch; on extensor surface, about center, a scar with sinus. No nerve injury. X-ray shows fracture of both bones; no union visible; two foreign bodies near anterior skin on inner side; one sequestrum on external aspect of fracture of radius.

February 8, 1919. Operation. Professor Morison Northumberland War Hospital. The three sinuses present were opened up. Two sequestra from radius and one from ulna were removed. The upper fragments of the radius and ulna (ununited) were chiseled and the chiseled portion turned into the gap. The lower fragments were freshened. The whole surfaces were "bipped" and the wound over extensor surface, which had been opened up more extensively than the others, sutured. The arm was put up in full supination and Gooch and metal splinting.

March 8, 1919. Dressed first time. One month. Dressing dry. Radius not united. Ulna firm. The radial wound was healed. The extensor wound was almost healed. The sutures were removed. "Re-bipped." Splints were re-applied.

April 6, 1919. Dressed. Healed. No union in radius. Put up in plaster of Paris. X-ray showed lateral position good. There is a slight angle pointing forward, but no bones are in contact.

September 1, 1919. Operation. Bone graft to radius. There were two healed scars over front and outer side of forearm. An incision was made over the front of the radius between the pre-existing scars, avoiding both. The radius was approached by deepening the incision between the flexor carpi radialis muscle and the supinator longus. As the fractured ends of the radius were exposed they were found ununited, with an imperfect attempt at fibrous union. A flap of bone and periosteum was turned down from the upper fragment. A flap of bone and periosteum was turned up from the lower fragment, forming a bed to receive the graft. An incision was made over the inner surface of the tibia and a graft of bone and periosteum was cut to size from the front of the tibia. Before the graft was removed from its bed, a plate, longer than the graft, was fixed to it with 2 screws, the protruding ends of the plate being secured to the upper and lower ends of the radius respectively after the graft was transplanted to the forearm. Difficulty was experienced in getting a firm screw hold into the lower fragment of the radius, owing to the friable and soft condition of the bone. The upper fragment was also soft and friable, but to a less extent. The muscles were drawn over the radius and the graft by three bootlace sutures of catgut. The skin was united with fishing gut and catgut. The wound on the tibia was sutured. The arm was put up at right angle flexion of elbow. The forearm was fully supinated between the Gooch splinting. A rectangular aluminium splint was applied. Plaster.

October 5, 1919. Apyrexical course since operation. General condition satisfactory.

October 31, 1919. Lower screw has sprung—graft still in position. X-ray shows some bone formation. Discharged with good union of bone and perfectly sound and useful arm and hand, with which he worked regularly at a pit lamp cabin. On January 24, 1921, the patient returned to have the metal plate removed as the lower end sprang out when he was working and was projecting under the skin, causing him inconvenience.

January 28, 1921. Operation (removal of plate) 1 year and 4 months after grafting operation. The tissues were found to be so firmly incorporated with the plate that they had to be cut off it. No sign of irritation. The lowest screw was partially (not totally) loose; the two next had a quite firm hold; the top ones also very firm. (They had become more firmly fixed after operation.) Skin sutured with interrupted sutures of catgut. No splints.

February 14, 1921. Dressed first time. 17 days. Healed by first intention. Quite dry. Sutures absorbed.

Summary. Pens. P., age 24, wounded October 27, 1918. Non-union of radius. Last operation September 1, 1919. Professor Morison. Bone graft to radius fixed with long

Lane plate. October 31, 1919. Lower screw sprung. Discharged with good union of bone and useful hand. Worked regularly until January 24, 1921, then returned to have plate removed as the lower end was projecting and causing inconvenience. January 28, 1921. Removal of plate—17 months after grafting operation. February 14, 1921. First dressing—17 days. Healed by first intention.

CASE 26. Age 38. Gunshot wound left forearm, fractured radius. Wounded September 28, 1918, at Hooge.

Admitted, October 25, 1920. Healed scar over the posterior surface of the middle of the left ulna. The hand was held in the prone position. Much radial deflection. The movements of the fingers and the thumb were sluggish. Passive movements were good. X-ray showed gap in Radius.

October 27, 1920. Radiant heat to arm—6 applications.

November 5, 1920. Operation. Professor Morison. Long incision (about 7 inches) on anterior surface of left forearm directly over the anterior edge of the supinator longus muscle. This muscle edge was identified and retracted laterally and on the medial side the flexor sublimis digitorum was medially deflected. The periosteum was incised vertically at the site of fracture, then peeled off. The lower fragment was found to terminate in two horns of bone, one anterior and the other posterior. Both these horns were sawn off, the anterior one being removed entirely, and part of the posterior one being left in the wound. The irregular end of the upper fragment was sawn off transversely. The arm was then forcibly manipulated to undo as far as possible radial deflection. Next a graft of bone 2 inches by 1 inch was cut with the Albee saw from the subcutaneous area of the left tibia. Two plates were applied *in situ*, the plates being each 3 holed. One screw of each plate was applied to upper and lower ends of graft. Graft removed and fitted into interval in radius. The remaining screws on each plate were fixed to the upper and lower fragments of the radius respectively. The muscles were sutured with three figure eight sutures of catgut; the deep fascia with interrupted catgut; and the skin with interrupted silkworm and fine catgut. The thigh was sutured with silkworm-gut. A special right angle Treves aluminium splint had been specially made for this case and this was used together with anterior and posterior gooching splints for forearm, to maintain it in supination.

November 11, 1920. Arm was put up in plaster-of-Paris bands, patient allowed up. (Dressing not touched.)

December 6, 1920. Patient complained that the splint had slipped and was uncomfortable, so dressed—31 days after operation. The wound was quite dry. On the lower end of the tension incision was a granulating area, the size of a split pea. Abundant callus could be felt and the bone appeared firm. The sutures were removed. Spirit dressing. Flannel bandage and plaster-of-Paris. Thigh healed.

January 14, 1920. Plaster removed. Wound healed. Large amount of callus. No callus or union shown on X-ray but bone felt quite firm. Patient very anxious to start work.

Summary. Pens. P., age 38, wounded September 28, 1918. Fracture of radius. X-ray showed gap in radius. No union. Operation, Professor Morison, November 5, 1920, bone graft—2 plates. Dressed December 6, 1920—31 days. Wound dry. One small granulating area unhealed. Abundant callus. Bone appeared firm. In 2 months patient started working in shipyard. New bone quite strong.

CASE 27. Pens. S., age 26. Gunshot wound left leg. Fractured tibia. Hit by bullet on September 21, 1917, in the left leg, while in France. The tibia was fractured and there was a lot of consequent sepsis. No union of tibia. A bone graft was put in on October, 1919. The wound healed, but no union followed. X-ray showed bone graft in position.

December 10, 1920. Operation. Professor Morison. Non-union exposed through vertical incision. Bone graft left *in situ*—it was adherent to the surrounding tissue and vascular, but there was no union to bone. Bone ends were cut down and platformed to leave a bony upper and lower bed for the new graft. Old graft rawed with chisel—The graft was cut from opposite tibia. During its removal the graft was fractured in the middle owing to difficulty from sclerosis due to the previous operation. The broken graft was repaired by one plate, and two other plates fixed the graft to the prepared ends of the tibia. The leg was put up in two side Gooch splints, reaching from above the knee to the sole and fixed by three plaster-of-Paris bands.

January 14, 1921. Dressed for first time—5 weeks. Dressing looked quite dry—dry blood clot lying around it. On removing this a drop of pus from the center of the wound could be squeezed out. Sutures removed. Leg felt firm. "Bipped," and put up in Gooch splints with plaster-of-Paris bands.

February 7, 1921. Dressed for second time. Quite dry. A small unhealed spot (pin head). Rest of wound healed. Union felt firm. Put up in plaster-of-Paris, with window cut over unhealed area.

March 11, 1921. Patient has been home for a month and returned today as he *thought* the wound had been discharging into the dressing for 3 days. On taking down the dressings the wound was found to be quite dry and healed, and the bony union firm with abundant callus. Scar smeared with "bipp." Dry dressing.

April 28, 1921. Huge mass of bone is present showing quite firm bony union. No lateral movement is obtainable. The scar has broken down and plates are to be removed.

May 3, 1921. Operation. Professor Morison. Plates removed from tibia—found to be satisfactorily united. Wound sutured with silkworm-gut.

May 13, 1921. Dressed. The wound partially sloughed. No bone is exposed. To be dressed daily.

June 13, 1921. Still a little discharge from granulating areas. Union is firm—big mass of bone present. Patient is walking with a caliper splint.

July 11, 1921. Very little discharge is present.

Summary. Pens. S., age 26, wounded September 21, 1917. No union of tibia. First operation for bone grafting October 1919, by Albee method, which failed as graft did not unite. Last operation December 10, 1920. Professor Morison. Bone graft. 3 plates. January 14, 1921. Dressed first time, 5 weeks. Not quite healed. Leg felt firm. March 11, 1921. Quite healed. Bony union with abundant callus. April 28, 1921. Now strong thick tibia. Plates to be removed. May 3, 1921. Plates removed. May 13, 1921. Dressed. Wound edges partially sloughed. No bone exposed. June 13, 1921. Still some discharge from granulating areas. Union firm. Patient walking on caliper splint.

CASE 28. Pens. R.P.W. Age 32. Wounded April 13, 1917, at Arras. "Blown up" by a German bomb. Either 7 or 8 operations had been done before admission. Notes state that the head of the humerus was removed.

On admission July 16, 1920. Absence of head of left humerus. There is a healed scar running downward on the anterior surface of the upper arm from the middle of the acromion process. A large sinus tracks upward. The elbow joint normal. The scapular movements are good, but his arm hangs helplessly by his side.

Treatment. For sequestrectomy of humerus and subsequent fixation of shoulder operation when arm is satisfactorily healed.

July 23, 1920. First operation. The sinus was excised and fully exposed; well scraped out; dressed after "bipp" method. No deep focus of infection was found. The wound was sutured. No drain.

August 10, 1920. Dressed first time—18 days. Upper two-thirds of wound healed by first intention. At lower

third an opening discharged seropurulent fluid. "Re-bipped."

September 13, 1920. Healed. After 10 days of radiant heat, the patient was discharged soundly healed.

January 10, 1921. Patient returned for fixation of shoulder to have radiant heat for 10 days.

January 20, 1921. Finished radiant heat treatment. No breaking down of scar. Patient has been wearing an abduction frame made to fit him for a few days, to ensure its being comfortable after the operation.

January 21, 1921. Operation. Professor Morison. Lateral incision over site of destroyed deltoid down to the remains of the joint and upper fragment of humerus. The head of the latter bone had entirely gone, together with the two tuberosities. The glenoid cavity was exposed, and by means of an Albee drill a hole was bored upward, backward, and inward from its center. The humerus was then exposed for 1¼ inches. It was cut transversely through two-thirds of the shaft, 1½ inches from the end, then longitudinally on each side into the medulla, and the separated fragment was turned up and over, still attached by its extremity, to form a bed for the graft. A pointed-end graft was then cut from the subcutaneous surface of the tibia, and the sharp end of the graft was held by strong forceps and hammered into the drilled opening in the glenoid. The distal end of the graft was plated down to the humerus in the plateau already prepared. The acromion process was then split horizontally and the lower half was fractured downward to the graft (as illustration). An osteoperiosteal graft was chiseled up from the tibia and placed in position over the bare outer surface of the graft and sawn acromion. Fibrosed muscles were sutured over with catgut. Skin edges approximated with catgut. The arm was put up in abducted position on a frame and fixed with plaster-of-Paris.

March 7, 1921. Dressed for first time—6 weeks and 3 days. Wound healed with the exception of two areas—one at the lower edge of the wound, the size of a split pea; the other just over the acromion process, size of a pin head. A large mass of callus was palpable all round the glenoid, and there was no trace of movement. The bones appeared to be united. "Bipp." Boric powder. Dry dressing. Put up on frame and plaster-of-Paris as before.

April 15, 1921. Dressed second time—6 weeks since last dressing. There is a small granulating area, the size of a split pea, over the acromion process. Rest of the wound is healed. Large mass of callus is present. Union is quite firm. There is good movement of scapula. The arm is to be taken down from abduction frame every day for massage and dressing.

April 28, 1921. Arm in good position—down to side now. Not quite healed. Plate appears to rock—to be removed.

May 6, 1921. Operation. Plate removed.

June 13, 1921. Healed. Mass of callus union not solid.

June 17, 1921. Arm put up on abduction frame with plaster of Paris.

Summary. Pens. R.P.W., age 32, wounded April 13, 1917. Seven or eight operations before admission. Head of humerus had been removed for ankylosis of humerus to scapula. Last operation January 21, 1921 Professor, Morison. Bone graft.' Plate at lower end. March 7, 1921. First dressing—6 weeks and 3 days. All healed except two small granulating areas. Large mass of callus present. Bones appear to be united. April 15, 1921. One small granulating area unhealed. Union at both ends appeared firm. Large mass of callus. Good movement of scapula. May 6, 1921. Operation plate removed. June 13, 1921. Healed. Big mass of callus, union not yet strong. June 17, 1921. Arm put up on abduction frame and plaster-of-Paris.

Case 29. Pens. C.A.N., age 21, wounded on April 28, 1917, at Arras, by a bullet—range 300 yards. Was taken prisoner by the Germans for 10 months and was operated upon during that time. Has had 3 operations before admission. Note from English Hospital.

February, 1919. Compound fracture of humerus, middle third, non-union. Arm, forearm and hand much wasted; 15 degrees of movement at elbow; extension at elbow not beyond 90; wrist stiff at about 180; fingers stiff and contracted by flexor tendons.

February 17, 1919. There are the remains of a median nerve lesion in this case with some sensory loss in index and thumb. Despite the appearance of the arm, every muscle has power and reacts to faradism, except perhaps opponens and abductor pollicis.

May 23, 1919. For bone graft or wiring.

May 30, 1919. Left hand cock up splint. Movements wrist and finger joints under gas.

September 22, 1919. Operation. Long incision was made and the wound scar was included in the ellipse and excised. The musculospiral nerve was identified and retracted. The lower end of the bone was found very much rarified—marrow soft, almost fluid and yellow. The two ends were "stepped" and wired. The musculo-spiral was displaced to a more superficial position and embedded in muscle. Arm fixed in abduction splint. X-ray showed both wires round upper fragment and ends separated without union.

November 24, 1919. Operation. Incision as before. Musculospiral nerve identified and displaced. The ends of the fragment were sawn across until a flat, healthy surface was reached. A plate of boiled beef bone (shin of ox) was drilled with 2 holes at each end, and the ends of the fragments were drilled also. These were threaded with kangaroo tendon and tied securely. The whole length of the graft was wrapped closely to the fragments by chromic catgut. Muscles sutured with catgut, skin with silkworm-gut. The wires were removed at an early stage.

December 2, 1919. A stitch at upper angle has suppurated—small Carrel tube inserted.

January 11, 1920. Transferred to Newcastle.

January 14, 1920. In plaster. Awaiting bone graft. During the year has been having massage to improve condition of hand. Also radiant heat.

January 26, 1921. Wearing a special abduction frame to ensure its being comfortable after operation.

January 28, 1921. Operation. Professor Morison. An incision was made on outer side of the arm excising the old scar, and longer than the previous one. The musculo spiral nerve was identified in the scar and retracted to the outer side of the bone, the ends of which were turned out, without separating the soft parts from the conical ends, and exposed. The upper end, narrow in diameter and friable in consistency, was bared of its periosteum above the end and the sclerosed extremity was partially sawn through. The upper half of this fragment was turned down into the space between the bone ends. The lower end was exposed, found irregular, and dealt with in like manner. By means of a gouge the medulla and soft bone from the lower end were scraped out for just over one-half inch.

A pointed graft, sharpened at one end only, was then cut from the left tibia with the Albee saw, and the pointed extremity was driven into the gouged-out medulla of the lower fragment. The upper end of the graft was then brought into apposition with the upper fragment, lying on the turned in fragments from the two ends. In this position it was plated, 2 screws being applied to the friable bone end neither of which had any grip, and 2 to the graft. In order to secure this temporarily a thick catgut ligature was passed underneath the upper fragment and over the plate and screws. A small osteoperiosteal graft was chiseled up from the tibia and applied to the junction of the bone with graft at its upper end. Muscle and scar

tissue were approximated over graft with catgut sutures. The skin was sutured with silkworm-gut. The arm was put up on celluloid abduction splint with plaster-of-Paris jacket and bandages. Leg wound closed with fishing gut.

March 11, 1921. Dressed first time—6 weeks. A little moisture, about ½ dram, on dressing—not purulent. Sutures had all held, and except for a little place in the center, one-quarter inch long, which was granulating, and for a split-pea sized granulation in the upper third, the wound was healed. Union firm. "Bipp." Dry dressing. Boric powder. The arm was put up against the chest with abundant cottonwool and retained in position with plaster-of-Paris bandages. The hand was left free.

April 22, 1921. Dressed second time—6 weeks since last dressing. Quite dry and entirely healed. Union firm. Arm put up in sling—no splints. To start movements of fingers.

Summary. Pens. C.A.M., age 21, wounded April 28, 1917. Fracture of humerus. Three previous operations—wiring and step method and bone grafting of humerus. Last operation January 28, 1921. Professor Morison. Bone graft and plating. Dressed March 11, 1921—6 weeks. All healed except one small granulating area. Union of graft appeared firm. Second dressing April 22, 1921—6 weeks. Entirely healed and union firm.

CASE 30. Pens. K., age 27. Gunshot wound left humerus. Wounded September 16, 1916, in France, by shrapnel. Fracture. Has had 5 or 6 operations when attempts were made to wire and plate the humerus.

On admission, May 14, 1920, there was an ununited fracture in upper third. Little loss of bone substance. X-ray: irregular upper fragment—lower squared off.

August 25, 1920. Operation. A long incision was made along the anterior border of the deltoid. A large amount of scar tissue was excised. The bone ends were exposed, squared off, and cleared of scar. Step cuts performed on the two ends. Two holes were drilled and silver wire was passed through, tightened, and the sharp ends buried. The muscle was closed over bone, and the wound sutured. The arm was put up on abduction frame.

The wound healed almost immediately and without removing the wire. The X-ray result appeared excellent, but on taking the arm off the splint, it was found that there was only fibrous union.

February 4, 1921. Operation. Professor Morison. Excision of old scar. Non-union exposed. The wire inserted in the previous operation was extracted. What union existed was purely fibrous and there was no deposit of new bone, despite the accurate apposition of the fragments. The sclerosed bone ends having been cleared and separated were partially sawn through and turned up at the distal end into the gap. The proximal bit was removed, leaving a shelf for the graft to lie on. A tibial graft, a wide one, cut the length of the gap left after forcible stretching of the upper arm, was marked out with the Albee saw and before complete removal from its normal position a three-screwed plate was applied at either end—the single screw on the graft. The graft with plates affixed was then lifted out and placed on the prepared shelf in the humerus. Holes were drilled in the lower fragment of the humerus and screws inserted. The bony tissue of the upper fragment would not grip the screws, and so the upper plate was removed. Catgut (thick and doubled) was passed around the graft and upper fragment and in this way some immobilization was maintained. The bone was so soft that when held with forceps it collapsed. The muscles were approximated and the skin sutured with silkworm-gut and catgut. The arm was put up by the side and enclosed in plaster-of-Paris.

March 18, 1921. Dressed first time (6 weeks). The old scars had broken down in several places and left protuberant granulations. Incision scar was all healed except for pin head granulations opposite six of the sutures. The anterior scar had broken down, forming granulating area, size of sixpence. Union of graft appeared quite firm. "Bipp" and boric powder dressing. Arm put up as before.

April 24, 1921. Dressed second time—5 weeks and 3 days. Firm union. Good movement of shoulder. Granulations as before. Incision wound healed. To be dressed daily.

April 28, 1921. Still a granulating area in center of scar.

June 13, 1921. Two small granulating areas—at the bottom of each of these bare bone could be felt. Large amount of callus, but union not solid.

July 1, 1921. Granulations have been touched up with nitrate of silver. The arm has been put up on abduction frame with plaster-of-Paris.

July 15, 1921. Operation. Plate removed. Firm union.

Summary. Pens. K., age 27, wounded September 16, 1916. Fracture of left humerus. Five or six previous operations. Attempts to step method and wire and plate humerus. Last operation February 4, 1921. Professor Morison. Bone graft and plate. Dressed March 18, 1921 (6 weeks). One or two small granulating areas in scars. Union of the graft appeared to be firm. June 13, 1921. Probe through granulations touched bare bone. Large amount of callus, but union not solid. July 15, 1921. Plate removed. Bone firmly united.

I wish to thank Dr. Arnison and his department for the X-ray photographs; Captain Russell for the drawings and for diagrams from X-ray findings; and Colonel Greig for leave to publish the cases.

CONCLUSIONS

Clinical observation and experience are still of more value than laboratory findings and experiments in connection with the condition of wounds and as a guide to their treatment.

The "bipp" method of treatment of infected wounds has established the fact that, by the use of suitable antiseptics, such wounds can be closed with impunity and that healing "by first intention" may follow.

If it is possible to close infected wounds with impunity, it should also be possible to open abscesses and, after treatment of them with antiseptics, close them again. The cases recorded show that this can be done.

Septic bone cavities have been the most prolonged and troublesome results of the late War. The largest and most obstinate can heal after treatment by the "bipp method" and if filled with fat grafts, by "first intention."

If the wound opens up, or the skin covering it sloughs, exposing the fat grafts, these need not be extruded but will gradually become vascular and eventually will be replaced by new bone. Difficulty in obtaining a satisfactory skin covering is the chief cause of delayed healing.

Failures after fat grafting are the result of faulty technique.

Bone grafts. Lane plate fixation of bone grafts can be successful where other methods have failed.

THE MOURE OPERATION FOR REMOVAL OF LARGE GROWTHS AND FOREIGN BODIES FROM THE ANTRUM[1]

By VIRGINIUS DABNEY, M.D., F.A.C.S., Washington

THOSE of us who had the pleasure and profit of studying in the clinics of Germany and Austria in those halcyon days before the Great War will doubtless recall how aghast we sometimes were at the operative procedures we witnessed there which seemed to take no account of cosmetic results and to ignore the comfort and convenience of the victims. Thus, the operation of lateral rhinotomy, which Moure developed and really devised, would appear to be a mutilating and bloody procedure, whereas, properly performed, it is neither the former nor especially the latter. It is due to the boldness of conception and skill of performance associated with an intimate knowledge of the special anatomy involved, that such operative methods are devised and are successful in their performance.

The especial place for this operation is where the naris is crowded with neoplasms, either benign or malignant, single or multiple, which are evidently overflowing from the antrum, though there are usually in addition independent foci in the ethmoid and even sphenoid; and, moreover, where repeated removal through intranasal methods has proved futile in preventing recurrence. Usually deformity and dislocation of the eye, cheek, and nose, especially the eye, occur before the extensive nature of the disease suggests itself to the attendant or patient. The reason for this is that an accumulation in the open naris does not cause the deformity, as a rule, but that one in the interior of the antrum does. Thus, while the growths are being removed carefully and thoroughly from the open cavity of the nose, those in the antrum continue to grow and their pressure increases, despite the intranasal work, until the cheek, eye, and even the roof of the mouth show the characteristic deformity of great and unrelieved pressure.

The technique which I employ is essentially that of Moure, aside from those minor details which every surgeon is apt to exhibit, such as the control of hæmorrhage, the use of retractors, and the postoperative care. Argyrol is first instilled in the eye of the operative side, the face is then painted with tincture of iodine, which is immediately removed with alcohol, and the eye covered with a pad wrung dry from a bichloride solution. The usual towels are draped over the head and neck to cover all but the part to be attacked. A curved incision is made, parallel with and one-eighth inch below the infra-orbital margin, beginning at and below the outer canthus and extending to a little below the inner canthus. From this point it is carried straight down, along the juncture of the nasal ala and the face to the edge of the nasolabial junction. The bleeding is, of course, brisk and must be controlled as the incision is lengthened, step by step, as the blood will completely obscure the field and prove very embarrassing unless so arrested. Having secured a practically dry field, the periosteum is now elevated, and it must be done with the utmost care and thoroughness, avoiding not only tears but also leaving *in situ* any of its extent. Upon this seemingly unimportant detail depends at least half of the success of the surgeon's attempts to secure a good cosmetic result. In order to prevent bruising of the parts and the possible formation of slough, it is important at this stage to remove all artery clamps where they can be dispensed with and to retract this roughly triangular flap with a loop of silk run through the apex of the tissues; in other words not with metal retractors. Here, again, an effort is made to insure primary union of the soft parts for reasons previously stated. The ala of the nose is now elevated and access gained to the nasal bone and the nasal process of the superior maxilla, and all hæmorrhage controlled. Before proceeding with exposure of the interior of the antrum and naris, the posterior naris is packed and the use begun by the anæsthetist of an aspirator such as is used in tonsil operations. This instrument must be kept continuously in the throat to catch any blood that may escape through or around the nasal packing until all the growths have been removed, the hæmorrhage controlled, and the general cavity packed. The separation of these masses, especially when malignant, is attended generally by profuse flow of blood which, of necessity, would proceed down the rhinopharynx and into the trachea unless preventive measures had been taken well in advance; even so, it is at times necessary to renew the packing because of its becoming saturated with blood. With a square-edged chisel, a section of bone is now marked out, corresponding in extent and contour with

[1] Read before the American Academy of Ophthalmology and Otolaryngology October 19, 1921.

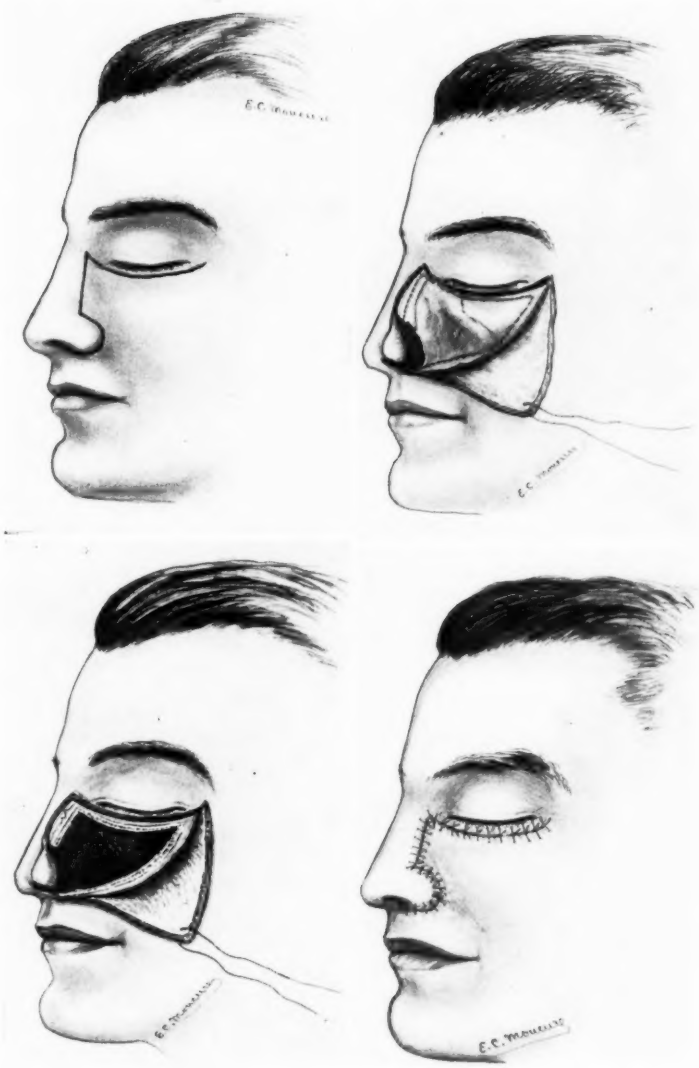
the skin flap, but with this additional area: the posterior half of the nasal bone and so much of the nasal process as may be necessary to allow free inspection of the interior of the nose and the ethmoid. When this area marked out by the chisel has been broken out with suitable forceps, there lies before the eye the entire interior of the antrum and nose, easily accessible to any instrumentation that may be required by the special necessities of the case. No other method will so reveal this general cavity or even if attempted will do so with such safety and thoroughness. It is now an easy matter to remove all growths from their numerous attachments, either in nose or antrum, and I personally prefer the finger where possible, supplemented by curettement of the entire surface and removal of all tags and shreds with any grasping forceps, my preference being the Luc. After packing with gauze impregnated with Dakin oil solution, the wound is sewed up in two layers, care being taken in approximating the skin edges. The end of the packing is pulled down to the edge of the nostril, where it is readily found to be removed on the third day. An ice bag is kept on the cheek continuously for 2 days. In the absence of malignancy, or much foul discharge, a repacking is not usually necessary, though this can be done if the attendant wishes, as the nostril offers all the room necessary for it and for free inspection. Gentle, warm saline irrigation two or three times daily is usually all the after-care that is required in benign cases. However, in the presence of malignancy, the wound cannot be closed, but must be left open and treated as any other open wound, and the use of the X-ray and radium persisted in. With this exception, generally there is no depression or deformity in the face; in fact, where primary union takes place the scar is hardly visible.

The removal of foreign bodies by the route of this operation is essentially the same as described for that of neoplasms, though the interior of the nose may not require exposure, and, in this event, the removal of the bony flap involving the nasal bone and the nasal process may be omitted. However, it will still be necessary to elevate the nasal ala and push it aside to give sufficient room for manipulation of the rest of the flap. Foreign bodies gain entrance into the antrum and nose as the result of industrial accidents, such as the breaking of a flywheel or other revolving and rapidly moving mechanical devices, with the breaking loose of steel masses, striking a patient in the cheek and nose. Also, during the war, instances were numerous where projectiles in whole or in part found their way into the antrum. In this latter type of injury, the skin incision must take into account the wound of entrance and will accordingly depart from the classical incision described here. For instance, there came into my hands a soldier who had received a piece of shell casing just below the malar bone, which had made its way into and through the antrum, emerging through the hard palate. However, in its journey it had split, leaving half of its bulk in the antrum. Here, obviously the thing to do was to follow the wound already made, and the base of the triangle was reversed, being at the infra-orbital margin, and the shape of the incision was more crescentic than triangular, including the nasal incision within its curve. This young man had had for years an empyema of that antrum which was permanently cleared up as an incident of the operation for removal of the fragment of shell casing.

To anyone who has done war surgery and to plastic surgeons whose extraordinary achievements during the war are well known, this operation is almost absurdly easy, but it was not given to all of us to have such experience, and thus the Moure operation as a means of creating and approaching the joint cavity of antrum-nose-ethmoid should be kept in mind and a description is not out of place for the rhinologist.

Rather than giving the arid details of cases I will describe only one, especially as this patient had the rare and somewhat undesirable experience of having both sides operated upon, the second operation involving the frontal sinus as well as those usually affected.

A colored boy, age 19, desired relief for nasal stoppage of the right side, and examination revealed complete blocking of that side with numerous grayish polyps, and perhaps slight bulging of the antral wall anteriorly. Repeated removal of these growths gave no permanent relief, as they reformed rapidly, and the antral wall gradually bulged forward, but this was the only deformity noticeable. A roentgenogram showed marked density and another rhinologist performed the classical Moure operation, at which I happened to assist. The interior was crowded with slippery growths found subsequently to be fibromyxomata, but the skin incision did not hold well and there was slight depression of the scar, the patient remaining in the hospital several weeks. A year and a half later he returned and fell into my hands. At this time the right naris was free of growths, but the left was now full as in the first instance, the cheek bulging, the eye prominent downward and forward, causing the so-called "frog face". He complained not only of difficulty in nasal respiration but also of headache referred to the brow and vertex. The roentgenogram showed, of course, equal density on both sides, but as I was familiar with the history of the case, I at once operated and found a characteristic condition—antrum, ethmoid, and nose



Author's modification of Moure operation to remove large growths and foreign bodies from antrum.

crowded with fibromyxomata. However, as the brow was distinctly soft and bulging and the orbital plate completely destroyed, I made an incision in the hair line which joined the other incision at the canthus, and removed the anterior frontal wall, finding the entire floor of the sinus gone and the upper third of the globe of the eye well within the frontal sinus limits. There was obliteration of the anterior ethmoid; so that there was already ample drainage into the nose. Thus, the frontal sinus, naris, and antrum were thrown into a common cavity, and the frontal and facial wounds healed by first intention, the patient leaving the hospital in a week with no scar visible. Three weeks later, he returned, showing a break in the wound in the center of the cheek, but this healed in a few days and did not mar the cosmetic effect in any way. Eight months after this visit the condition was still good with no return on the left, but on the right, the side first operated upon, there was a return of the growths, though he appeared well and was not in especial discomfort from this accumulation. He has not returned now for a period of 2 years.

This operation appeals to me for its safety, rapidity of convalescence, and absolute certainty of removal of all growths and diseased tissue. Nothing can take the place of the ability on the part of the operator to see what he is doing and what the conditions require him to do. Such desiderata cannot be obtained so well, if at all, by any other method of relieving the condition for which the Moure operation is devised and properly applied.

PRACTICAL METHOD OF FIXATION IN FRACTURES OF THE MANDIBLE[1]

By ROBERT H. IVY, M.D., F.A.C.S., Philadelphia
Professor of Maxilla-Facial Surgery, Graduate School of Medicine, University of Pennsylvania

SURGEONS as a rule show little direct interest in fractures of the lower jaw, and the principles that should govern the fixation of these injuries frequently appear to be imperfectly understood. The usual method adopted is the application of the Barton or other head bandage, in the belief that this provides sufficient fixation. The bandage alone is no more reliable here for retention after reduction of displaced fragments than it would be in a fracture of any other bone. Only cases which would do well without any form of fixation whatever show satisfactory results after treatment with the bandage. In the mandible, more accurate restoration of the parts is essential than in other bones, because the slightest deviation will produce mal-occlusion of the teeth and interfere with mastication. The essential principle to be followed, therefore, is fixation of the fragments in proper relationship with the upper jaw. In order to minimize infection and the prolonged treatment resulting therefrom, this fixation should be applied as soon as possible. It is impossible to maintain the upper and lower teeth firmly in occlusion with a bandage, and if the fragments are properly fixed otherwise, no bandage is necessary, except to hold a dressing in case of external wound. Sometimes, in a case of difficult reduction, the surgeon may be tempted to wire or plate the fragments, forgetting that nearly all mandibular fractures are compound into the mouth and are constantly bathed in the oral secretions. Infection occurs around the wire or the metal plate, inviting osteomyelitis with sequestrum formation and great delay in union. The only justification for wiring or plating of the fragments is one of those rare cases of fracture in an edentulous person where the oral mucous membrane has not been broken and where there is consequently a chance of maintaining asepsis. Even here, the wire or plate usually gives insufficient stability.

After a mandibular fracture has been treated unsatisfactorily for several days, either by bandaging or by an open operation, and infection at the site of fracture has become well established, the patient frequently is referred either to an oral surgeon or to a dentist, usually the latter, with the request that an interdental splint be made. In large cities these patients come to the dental college clinics. It is unquestionably true that some form of interdental splint is one of the best methods of fixation, and in a few cases with great comminution and displacement is the only satisfactory treatment. There are many practical difficulties which interfere with successful employment of the interdental splint. The making of a splint demands considerable experience, at least 2 days of time devoted to nothing else, and involves some expense. Most cases of fracture of the lower jaw occur in persons in poor circumstances who apply for treatment at free dispensaries or dental colleges, where students have to be depended upon for the making of

[1] Presented at the meeting of the Clinical Congress of American College of Surgeons, October 25, 1921.

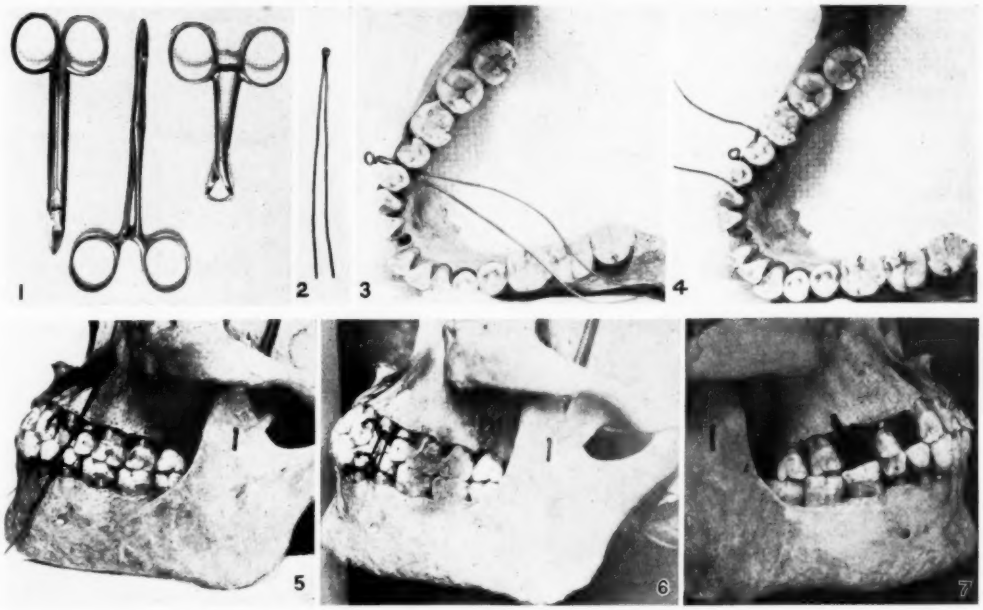


Fig. 1. Instruments required for manipulating wire; towel clamp hæmostatic forceps, aud short-nosed scissors.
Fig. 2. Wire twisted to form eyelet.
Fig. 3. Ends of eyelet wire inserted between premolar teeth.
Fig. 4. Ends of eyelet wire carried around premolar teeth back to buccal surface.
Fig. 5. Eyelet wires attached to upper and lower premolar teeth. Connecting wire passed through eyelets.
Fig. 6. Upper and lower teeth fixed in occlusion by connecting wire passed through eyelets. Ends of wires twisted, cut off, and bent over.
Fig. 7. Eyelet wire attached to single tooth in upper jaw.

splints. Busy dentists, even though experienced in this work, cannot give up all other patients and devote at least 2 days to making a splint. Dental students have other duties, such as attendance at classes to interfere, and moreover are insufficiently experienced to produce accurate splints in the desired length of time. Under these circumstances usually from 2 to 3 weeks elapse between the taking of the impressions and insertion of the splint, which even then may not fit accurately. In the meantime, unless some other means of fixation has been used, the fracture is in process of union in malposition. Therefore, for fixation of the average case of mandibular fracture, we do not now depend on splints, but employ immediate ligation of the lower to the upper teeth, thus reducing and fixing the fracture the first time the patient is seen. This being accomplished, the case may be carried to completion by means of the wiring, or the wires may temporarily suffice until a splint can be made and inserted.

The object of this communication is to bring to more general notice a method of wiring the teeth which, with a little study and practice, should be easily acquired by any surgeon and enable him to handle satisfactorily these cases of fracture of the mandible himself, particularly in localities where specialists are not available. In this way fixation of the bone and care of the soft tissues are under one person, as in other fractures, and there is no division of responsibility.

The method advocated here is a modification of that devised by Colonel Robert T. Oliver,[1] Dental Corps, U. S. Army, developed by Major Joseph D. Eby, of the same corps, and adapted to civil life injuries by the writer. The wire used should be of such a size that it will pass freely through the spaces at the necks of the teeth, and composed of a soft, yet resistant metal. For routine use, two kinds of wire are employed, 22 or 23 gauge copper wire, and the large size (24 to 26 gauge) Angle's brass ligature wire obtainable at any dental supply house. In emergencies, soft silver wire is usually to be found in every hospital, or an efficient substitute in the form of soft iron

[1] J. Am. M. Ass., 1910, liv, 1187-1191.

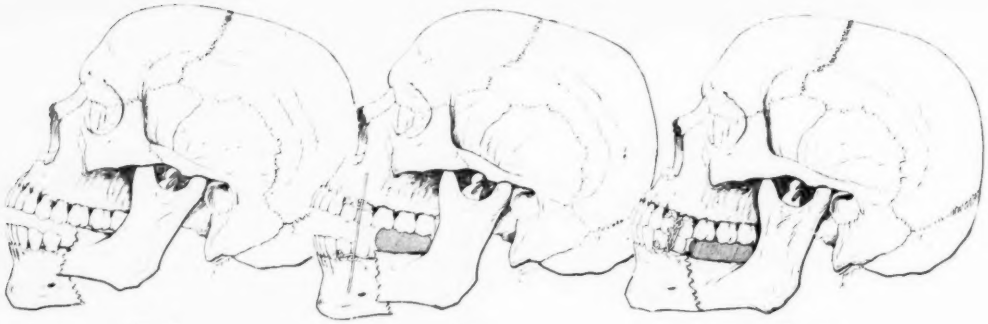


Fig. 8. Fig. 9. Fig. 10.

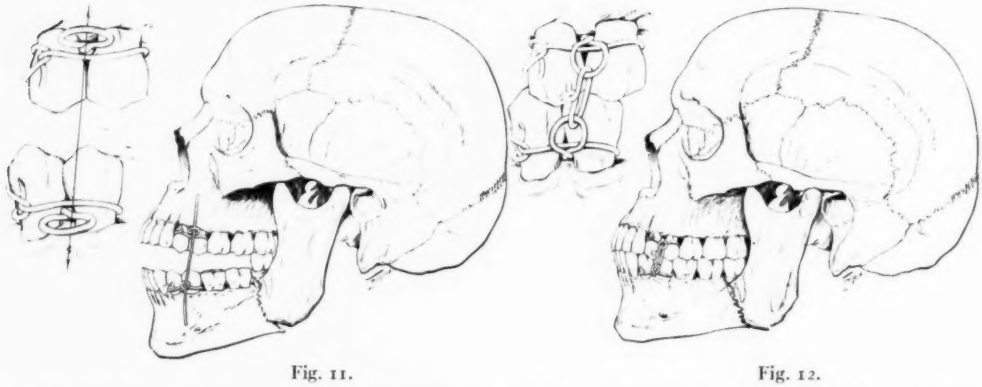


Fig. 11. Fig. 12.

Fig. 8. Fracture with a long posterior edentulous fragment which has been drawn upward by the muscles of mastication.

Fig. 9. Posterior edentulous fragment kept down by piece of impression compound.

Fig. 10. Fracture reduced and anterior fragment fixed by wires.

Fig. 11. Retention of tooth in line of fracture to prevent tipping up of posterior fragment.

Fig. 12. Fracture reduced and fixed by wiring teeth.

binding wire can be purchased at any hardware store. The instruments needed are a pair of hæmostatic forceps, a pair of short nosed scissors, and a tenaculum or a Backhaus towel clamp (Fig. 1). In preparation of the wire to be attached to the teeth, a six inch length is folded around the tenaculum or towel clamp, and a loop is twisted in the form of an eyelet (Fig. 2). Where there is a good dental interspace, the copper wire is used, as it makes a firmer attachment. Where the teeth are set close together, as in the case of the lower incisors, the brass wire is employed. After selecting the teeth to be wired, both ends of the eyelet wire are inserted from the buccal surface through the interproximal space, for example, of the two lower premolars (Fig. 3). One end is drawn through around the anterior tooth and the other end around the posterior tooth on to the buccal aspect (Fig. 4). This process is repeated on corresponding upper teeth. Then the ends of the wire in the case of the lower teeth are twisted together with the eyelet projecting below the twist. In the case of the upper teeth, the eyelet projects above the horizontal twist. In this way the upper and lower eyelets are prevented by the horizontal strands from coming too close to each other when subjected to the strain of the connecting wire to be described. Tightening is done by grasping the ends of the wire with the hæmostatic forceps, drawing the wire away from the teeth and twisting carefully at the same time. The eyelet may be prevented from disappearing in the interproximal space by engaging it with the towel clamp. The ends are then cut off short and bent in so as not to irritate the lips (Fig. 5). The selected teeth on the opposite side of the mouth are then treated in the same manner, and if desirable a third set of teeth is similarly wired in

the incisor region. The upper and lower eyelets are now connected by passage through them of a third, connecting or tie wire, the brass wire being used here (Fig. 5), the teeth brought into occlusion and the ends of each connecting or tie wire twisted together, cut off short and turned in (Fig. 6). In some cases of displacement the desired movement of a fragment to restore proper occlusion can be produced by placing the upper eyelet in a position to the right or left of that of the lower eyelet as the case may be, instead of directly opposite. Complete reduction may not immediately follow placing of the wires, but will generally occur on taking up the slack of the connecting wires after 24 hours. A great advantage of this method is that if one wire breaks it can be easily replaced without disturbing the other eyelet wires. If the patient is to receive an anæsthetic, the eyelet wires may be placed before or during the operation and the jaws fixed with the connecting wires after the danger of nausea is past. The tie wires may be cut at any time in order to test the fracture. If consolidation is not complete the tie wires may be immediately replaced. The wires tend to loosen every few days, but can be easily tightened. The slight motion of the jaw due to loosening of the wires, as compared to the absolute rigidity of splints, is an advantage in the later stages of treatment, as it tends to stimulate bone regeneration. With the teeth wired in this way, the occlusion of the teeth is always under direct observation. Interdental splints usually cover the cutting edges and occlusal surfaces of the teeth, there often being a thickness of metal between them. The state of the occlusion cannot be observed during treatment, and when the splints are removed there may be considerable malocclusion. It is quite as easy, if not more so, to maintain cleanliness of the mouth with the wires as with splints. With attachment of the wires at three different points, the strain is well distributed and there is little tendency to loosening of teeth from this source.

In a series of over thirty mandibular fractures treated during the past year, this method of wiring was satisfactorily employed in all except two, regardless of the seat of the fracture. In one case, no teeth were present in the mouth, and in the other, an incomplete fracture at the angle without displacement, not even a bandage was required. This method necessarily entails locking the upper and lower teeth together, no matter where fracture is situated. But the disadvantage of this is not so important as the delay usually encountered in having a splint made.

When a tooth necessary as a point of fixation in one jaw stands alone and it is impossible to attach the usual eyelet wire, the attachment may be modified by twisting around the neck of the single tooth with eyelet on labial or buccal surface (Fig. 7).

Occasionally, a fracture of the body of the bone will be encountered in which molar teeth have been lost, leaving a long posterior fragment without teeth. In a case of this kind there is generally a tendency for the anterior end of the posterior fragment to be tilted upward by the temporal, masseter and internal pterygoid muscles, until the soft tissues covering the fragment meet the occlusal surfaces of the upper molar teeth (Fig. 8). To bring about reduction here, a piece of softened dental impression compound may be inserted to cover the gum over the posterior fragment, filling in the space between it and the upper molars, and allowing it to harden while the mouth is open (Fig. 9). The impression compound is then removed from the mouth, trimmed to as small dimensions as possible, and reinserted. The teeth on the large mandibular fragment are then wired in occlusion with the upper teeth, the impression compound at the same time keeping the posterior fragment down in place (Fig. 10). The compound may remain in the mouth for several days without change.

Ulceration of the gum overlying the posterior fragment sometimes is seen from pressure of the last upper molar. In this case it may become necessary to extract this tooth.

Roots of teeth encroaching on the line of fracture frequently give rise to infection sooner or later, and as a general rule the wisest plan is to remove them early, provided this can be done without too much traumatism to the fracture. However, in certain cases it may be advisable to retain such a tooth for a time even at the risk of infection. This applies to a fracture just in front of the last molar tooth, where loss of the tooth would mean upward displacement of the posterior fragment owing to lack of opposition from the upper molars (Fig. 11). After a week or 10 days of reduction, the posterior fragment will usually remain down in position and the tooth in line of fracture can then be removed (Fig. 12).

The method described of wiring the upper and lower teeth proves efficient for reduction and retention of over 90 per cent of fractures of the mandible met with in civil practice. For the occasional case, complicated by marked comminution or loss of bone substance, with destruction of teeth, in which fixation for several months may be required, the cast metal upper and lower splints, connected by removable lock-pins, are advised.

POSTOPERATIVE PERITONEAL ADHESIONS

An Experimental Study

By CARL S. WILLIAMSON, M.D., and FRANK C. MANN, M.D., Rochester, Minnesota
Division on Experimental Surgery and Pathology, Mayo Foundation

DURING the last 5 years we have made cursory observations on the formation of postoperative peritoneal adhesions following various operations within the abdominal cavity, and have tried out most of the procedures recommended for the prevention of adhesions. It is our purpose here briefly to give the results of these experiments.

The methods employed to prevent peritoneal adhesions may be divided into three groups: (1) prophylaxis, (2) foreign substances for the purpose of keeping the injured surface from contact with any other surface of the peritoneum, and (3) the retardation or inhibition of some element in the process of healing.

There is no doubt that the employment of prophylaxis, as emphasized by so many investigators of this subject, is the most important means at the surgeon's command of preventing adhesions. Whatever decrease there has been in postoperative adhesions can be attributed mainly to the development of better technique in which abuse of the peritoneum is obviated as much as is compatible with proper surgical procedure. The formation of peritoneal adhesions is a part of the process of healing, and in this respect should be properly guided by the surgeon and not necessarily prevented. In many operations, the formation of a certain amount of adhesions is desirable. In other operations, either because of absolutely necessary operative trauma or resulting pathological conditions, raw peritoneal surfaces are unavoidable and impossible to repair. Adhesions form on this base, and remedial measures only make the condition worse. A method which would prevent the formation of adhesions and yet allow normal healing would be of inestimable value in such cases. It was with the hope of discovery of such a method that our researches were conducted.

In attempting to prevent peritoneal adhesions, innumerable methods and substances have been recommended, for example: the stimulation of active peristalsis by purgation; change in the posture of the patient; various oils intraperitoneally, such as liquid vaseline and olive oil; fluid, such as normal salt solution; non-absorbable membranes, such as rubber dam, oiled silk, silver foil, tin foil, and collodion; absorbable membrane, such as catgut, cargile membrane, amniotic membrane, and fish bladder; viscid substances, such as glucose, dextrin, and gum acacia; various irritants, such as iodine and ether; and substances which will prevent the process of healing, such as sodium citrate and fibrolysin.

In attempting to determine whether any of the various methods or substances recommended are of value in the prevention of adhesions, it is necessary carefully to standardize the method of operation. We found this rather difficult since the reaction of the peritoneum varies quite markedly in individuals. There is also a great variation in species. The formation of adhesions in the rabbit is somewhat different from the same process in dog and in man. While we employed various species of animals, particularly the dog and the rabbit, we were convinced that conclusions applicable to man could only be drawn from the experiments performed on the dog. We also found it difficult to standardize a procedure involving the gastro-intestinal tract because of the wide individual variation in the formation of adhesions following trauma to this structure. After a number of observations, we found a technique which suited our purpose admirably.

TECHNIQUE

The operative procedures were carried out under complete anæsthesia and sterile technique. The liver was exposed and areas on each of the upper and lower surfaces were traumatized gently with dry gauze until bleeding occurred. We found that after such trauma on a dog's liver, adhesions between the traumatized surface and the parietal peritoneum on the upper side and the adjacent abdominal organs on the lower side always occurred. The material to be tested was placed over one of the traumatized surfaces of the liver. If the material was of any value, the result of preventing adhesions to the traumatized area was quite definite. The other traumatized surface of the liver was kept as a control, and it should be noted that adhesions never failed to occur. This gave us a procedure as nearly standard as could be hoped for.

After carrying out the foregoing procedure the abdomen was closed and after a definite length of time, at another laparotomy, the formation of

adhesions on the two surfaces of the liver was noted. In a few instances in which the material to be tested was not adaptable to this technique, various intestinal operations were performed and the material used over the line of suture. The latter experiments serve to emphasize the fact that the reaction of the peritoneum varies considerably in individuals.

RESULTS

Practically all the substances used to prevent peritoneal adhesions by keeping the injured surface from contact with other surfaces until healing takes place, can be included in three groups: (1) fluids, (2) substances which are absorbed, and (3) substances which are organized. We soon found that each group had some unsatisfactory elements. Fluids, such as sodium chloride, are hard to apply because they do not remain at the site of trauma, but gravitate to other portions of the abdominal cavity, depending on the position of the body. Substances that are absorbed, such as cargile membrane, may produce more reaction in the process of their absorption than the original trauma. Substances necessitating organization, such as rubber tissue and oiled silk, have the disadvantage of having to be removed subsequently.

Many of the procedures that have been recommended to prevent adhesions in man are not adaptable to standard laboratory conditions; we have, therefore, omitted some of them from our review. The list of substances actually employed under the standardized conditions, as described, includes paraffin oil, olive oil, lanolin, boric acid and lanolin, sodium chloride, iodine, ether, glucose, dextrin, silver foil, cargile membrane, catgut, and rubber dam. Our results in the employment of all these substances may be summarized by stating that our experiments did not develop anything of value in the prevention of adhesions. In many instances the substances were decidedly harmful.

As we have stated, the formation of peritoneal adhesions is a part of the process of healing, and it is questionable if it is ever advisable to interfere with the normal process. Sodium citrate is supposed to preclude the formation of adhesions by preventing the formation of fibrin and thus the process of healing. In our experiments it not only failed to prevent the formation of adhesions, but in some instances it seemed harmful, since the oozing of blood from the traumatized surface was prolonged.

After a careful consideration of the substances employed to prevent adhesions, it seemed to us that the value of such a substance would be enhanced, if, besides its usual attributes, it should liquidize slowly. The ideal substance to fulfill such requirements should have adhesive qualities that would enable it to adhere to the site of the traumatized area, thus keeping other surfaces from contact. The substance should dissolve slowly at body temperature and be absorbed from the general peritoneal cavity. The rate of dissolution should be such that the substance will protect the traumatized surface for several hours. It is almost needless to add that the substance should have many other characteristics, such as the possibility of sterilization, inert as regards healing, and the reaction of the peritoneum.

After experimenting with many substances, a mixture of gelatin and gum acacia seemed to furnish the desired characteristics. Both of these substances have been employed previously for this purpose. Gelatin seems to have been discarded because it irritated the peritoneum; acacia seemed to produce good experimental results, but was never given an extensive trial; the substances used separately have the serious objection of not adhering closely.

The gelatin and gum acacia were made into a solution in the ratio of 25 per cent of each to 50 per cent of water and produced a substance which differs in some respects from either of the mother ingredients. It has extraordinary adhesive qualities; so much so that at body temperature it will stick to practically everything, including the peritoneal surface. At room temperature it forms a tough membrane not unlike rubber. It is easily sterilized by boiling but does not remain the same after sterilization in the autoclave. At body temperature, it is a semisolid. The gelatin-acacia mixture, placed in the peritoneal cavity, sticks to the site of application, causes absolutely no reaction, dissolves slowly within from 4 to 8 hours, and is absorbed from the general body cavity.

THE METHOD OF PREPARING AND APPLYING THE GUM-ACACIA-GELATIN MIXTURE

The acacia should be obtained in lumps instead of in powder since the powdered preparation is not of a very good quality. It is powdered in a mortar and then dissolved in normal saline solution. An equal amount of gelatin is added and when both substances are thoroughly dissolved, the mixture is filtered through three or four thicknesses of gauze. The filtrate is then heated on the water bath until it is concentrated to the point at which the fluid content equals about 50 per cent of the mixture. While still quite hot the solution is poured into lead tubes of the type employed for tooth paste. After the tube is filled, the open

end is closed by folding until it is tight. The tubes are placed upright in a container with the screw-end down and boiled in water from 20 to 30 minutes. They are then removed from the water and dropped in a jar of 70 per cent alcohol which is kept tightly closed.

When applied at operation the folded end of the tube is grasped with a sterile hæmostat, held in hot water for a minute or two to liquefy the mixture, and then expressed at the desired site of application by simply unscrewing the top and rolling the closed end over the hæmostat. Care must be taken to keep the material from anything except the desired site, since its extreme adhesive qualities make it very difficult to handle.

SUMMARY

We have used the material in a large series of experiments and the results, on the whole, have been satisfactory. The traumatized surface of the liver heals well under the layer of solution. It would seem, therefore, that it has prevented adhesions, but bearing in mind the marked individual variation in the quantity of adhesions that may develop, we hesitate to state that it is of much practical value in their prevention. Furthermore, we have not as yet worked out a complete, satisfactory method of making and applying the mixture, so we do not recommend it to be entirely safe from the dangers of infection. We can, however, state definitely that of all the materials thus far advocated that we have been able to investigate experimentally, the gum-acacia-gelatin mixture offers the best chance for development. Our investigation of the various substances recommended for the prevention of peritoneal adhesions convinces us that surgeons are not justified in using them in the abdominal cavity.

BIBLIOGRAPHY

1. Baum, F. How to avoid adhesions in abdominal sections. J. Am. M. Ass., 1904, xxiii, 242.
2. Behan, R. J., and Nealson, W. A. Interperitoneal adhesions and their prevention. New York M. J., 1916, civ, 165-167.
3. Idem. Interperitoneal adhesions, their origin and prevention. Am. J. M. Sc., 1920, clx, 375-383.
4. Blake, J. B. The use of sterile oil to prevent intraperitoneal adhesions. Surg., Gynec. & Obst., 1908, vi, 667-670.
5. Busch, M., and Bibergeil, E. Experimentelle Untersuchungen ueber Verhuetung von peritonealen Adhaesionen. Arch. f. klin. Chir., 1908, lxxxvii, 99-130.
6. Byford, H. T. The significance of peritoneal adhesions following operations. Surg., Gynec. & Obst., 1909, viii, 576-578.
7. Clark, J. G. Anatomical considerations in peritoneal adhesions. Surg., Gynec. & Obst., 1909, ix, 601-607.
8. Craig, A. B., and Ellis, A. G. An experimental and histological study of cargile membrane. Ann. Surg., 1905, xli, 801-822.
9. Cubbins, W. R., and Abt, J. A. A preliminary report concerning the effect of foreign substances in the peritoneal cavity. Surg., Gynec. & Obst., 1916, xxii, 571-579.
10. Lauenstein. Quoted by Vogel.
11. Lyman, C. B., and Bergtold, W. H. Amniotic membrane for the prevention of postoperative peritoneal adhesions; a preliminary note. Surg., Gynec. & Obst., 1914, xviii, 762-763.
12. Marvel, E. Prevention of peritoneal adhesions by adrenal salt solution, with especial reference to the pelvis. J. Am. M. Ass., 1907, xlix, 986-990.
13. Morris, R. T. A report on experiments made with cargile membrane for the purpose of determining its value in preventing the formation of peritoneal adhesions. Med. Rec., 1902, lxi, 773-775.
14. Idem. Peritoneal adhesions. Am. J. Obst., 1906, liv, 764-770.
15. Mueller. Quoted by Vogel.
16. Paton, E. P. The surgical treatment of perigastric adhesions. Lancet, 1904, i, 357-361.
17. Pope, S. The use of citrate solutions in the prevention of peritoneal adhesions. Ann. Surg., 1914, lix, 101-106.
18. Idem. The prevention of peritoneal adhesions by the use of citrate solution. Ann. Surg., 1916, lxiii, 205-207.
19. Puls, A. J. The application of silver foil as a preventive of peritoneal adhesions. Surg., Gynec. & Obst., 1921, xxxiii, 186-189.
20. Reichelderfer, L. H. Postural treatment of postoperative abdominal adhesions. Surg., Gynec. & Obst., 1913, xvii, 755-757.
21. Stern. Quoted by Vogel.
22. Straus, D. C. Concerning the value of sodium citrate solution in the prevention of peritoneal adhesions. Surg., Gynec. & Obst., 1916, xxii, 602-609.
23. Sweet, J. E., Chaney, R. H., and Willson, H. L. The prevention of postoperative adhesions in the peritoneal cavity. Ann. Surg., 1915, lxi, 297-305.
24. Vogel, K. Klinische und experimentelle Beitraege zur Frage der peritonealen Adhaesionen nach Laparotomieen. Deutsche Ztschr. f. Chir., 1902 lxiii, 296-369.
25. Walker, M. H., Jr., and Ferguson, L. M. Peritoneal adhesions: their prevention with citrate solutions. Ann Surg., 1916, lxiii, 198-204.
26. Wilkie, D. P. D. The use of oil in abdominal surgery Surg., Gynec. & Obst., 1910, x, 126-132.

NEPHROTOMY AND DECAPSULATION FOR ANURIA, IN A CASE OF SINGLE KIDNEY; RECOVERY

BY SIMON S. LEOPOLD, M.D., AND MOSES BEHREND, M.D., F.A.C.S., PHILADELPHIA

THE references in medical literature to nephrotomy and decapsulation in cases of single kidney are sufficiently few to warrant the report of this case.

The case of W. D. Minningham, operated upon by Dr. Ill, of Newark, was one of congenital absence of one kidney, in which nephrolithotomy was done for anuria of 23 days' duration. The patient recovered.

The case of Butler—an anuria of 13 days duration, due to an inspissated thrombus, incident to trauma of the left kidney—was not truly one of single kidney, as it was found at necropsy that the right kidney was present, but atrophic.

The case of Tracy—a recurrent anuria, due to a calculus which operated as a ball valve in the ureter of a single functionating kidney—is not, strictly speaking, a case of single kidney, as at previous operation only the lower pole of the other kidney had been removed.

In Minningham's case, one kidney was congenitally absent. In Butler's and Tracy's, both kidneys were present, although in Butler's case one kidney was atrophic, and in Tracy's, one was diseased.

The case here presented is, we believe, unique in that right nephrectomy had been preformed 4 years prior to nephrotomy and decapsulation on the left kidney.

W. B., white male, first presented himself for treatment November 6, 1916, at the age of 17 years, with the following history: It was ascertained from the mother that when the child was 3 years of age, he had a thick, purulent urethral discharge, which was permitted to go untreated, and after a time apparently subsided. Except for the fact that the child suffered from nocturnal enuresis until 9 years of age, nothing further was elicited during his early childhood.

When the patient was 13 years of age, he noticed that he was unable to control his urine, and began to wet the bed at night. He also noticed that during the day time when he was at school, his clothing was always wet. This was most uncomfortable and necessitated wearing cotton and pads to protect the clothing.

This condition continued for almost a year, when a physician was consulted, who passed a metal sound into the urethra. It is probable, that at that time a urethral stricture was present and the involuntary dribbling was the overflow of retention. He was instructed to return, probably for dilatation, but did not do so. He again came under medical observation in July, 1916, with the same symptoms, and was treated by urethral injection for three months without relief. During this time no attempt was made to explore the urethra.

The patient first presented himself to us (Dr. Leopold), for examination and treatment, on November 6, 1916, when the history above detailed was obtained. Abdominal examination revealed the bladder greatly distended, extending to above the umbilicus. All attempts to pass catheters in the urethra were unavailing; not even a filiform could be passed. The urine contained a trace of albumin and many pus cells.

The self-evident diagnosis of impermeable stricture at the bulbomembranous junction with overflow of retention, was made, and immediate operation advised. The patient disappeared and returned 2 months later with the same symptoms, having had no treatment in the interim. Operation was again advised and urged. He was admitted to the Jewish Hospital on January 30, 1917, and on January 31, an external urethrotomy, without a guide, was performed by Dr. Nate Ginsburg. He was discharged February 19, 1917, in good condition, with the perineal wound healed. The urine continued to show pus. Subsequent treatments of dilatation and bladder irrigations were carried out.

The patient did well until March 9, 1917, when he was seized with severe pain in the right kidney region, and constitutional symptoms of infection. Examinations of Dr. Ginsburg on March 12 revealed "a mass completely filling the right hypochondrium dorsally, extending ventrally to the linea alba, and below to the transverse umbilical line. Murphy's first percussion sign over the right renal region was positive." The right kidney was removed on March 14, 1917. The following are the notes made at time of operation: "Under ether anæsthesia, the patient in the recumbent posture, a Mayo incision was made over the right lumbar region, dividing the muscles across their fibers. The kidney was exposed after removing the peri-renal fat, and was found to be almost 11 inches from pole to pole. The pelvis was hugely dilated, and the ureter was dilated to a calibre of about 1 inch, besides being kinked and twisted. The kidney was removed after clamping the renal artery and vein, the latter two being then tied with 3 separate ligatures. The ureter was next clamped about 1 inch above the bladder, and tied with 2 separate ligatures, the stump of the ureter being cauterized with carbolic acid. A Mikulicz drain was placed next to the stump of the ureter, and extending from the lower end of the wound. The wound was closed in the usual manner."

Pathological diagnosis. Hydro-pyonephrosis.

Convalescence was uneventful, and the patient was discharged from the hospital on April 7. The urine was still full of pus.

From this time, until September 12, 1919, he remained in good health, able to do a full day's work, and had no symptoms. His phenolsulphonepthalein output in October, 1917, was 50 per cent at the end of 2 hours, in January, 1918, it was 35 per cent, and in June, 1919, it was 35 per cent. The blood pressure varied from 108 to 118 systolic. The left kidney was considerably enlarged and easily palpable. The urine continued to show pus.

On September 12, 1919, the patient had an attack of left-sided renal pain and a sudden rise of temperature. A diagnosis of pyelitis was made. There was prompt response to eliminative treatment, and he was able to leave the hospital in 6 days.

From December 27, 1919, to January 17, 1920, he was a patient in the University Hospital for treatment of chronic cystitis. Repeated examinations for tubercle bacilli were negative. Bacillus proteus was found in culture. For the following 6 months, treatment with irrigations of mercurochrome was continued in out-patient department.

On January 5, 1921, he was readmitted to the Jewish Hospital in an attack entirely similar to that of the preceding September. He left the hospital on January 18.

On January 27, 1921, he was readmitted in a third attack, during which he had anuria for 16 hours. He was discharged on February 11.

On February 18, 1921, at 1 a.m., he was suddenly seized with intense pain in the left kidney region. This persisted and on February 20, anuria developed. On February 20 he voided 1 ounce of urine at 10 a.m. and 1 ounce at 2 p.m. He was again referred to hospital. On February 21, he voided no urine. Catheterization revealed bladder empty.

On February 22, 1 ounce of urine was voided at 1 a.m. Cystoscopic examination by Dr. C. S. Hirsh revealed the bladder empty. A catheter passed into the left ureter met a high obstruction. On February 23, he passed 1 ounce of urine. On February 24, 1 ounce of urine, almost pure pus, was voided. Blood urea on February 24, 75 milligrams.

At this time, the patient was very toxic, and looked uræmic, although he was conscious and rational and had responded very well to frequent sweats. He was seen in consultation by one of us (Dr. Behrend), and immediate operation advised.

"Under nitrous oxide and oxygen anæsthesia, the kidney was exposed through an incision at the border of the ribs in the left loin space. The kidney extended almost 4 inches below the border of the ribs, was broad, and readily palpable, on account of its great size, its upper border impinging on the diaphragm. It was not delivered for fear of causing too much strain on its hilus, thereby endangering the blood vessels. The kidney could be inspected very easily through the incision. It was paler than normal and resembled the kidney of cloudy swelling. On account of the many symptoms above referred to, it was thought that there existed a pyonephrosis. A nephrotomy at the lower pole, and at the convex surface of the kidney revealed no pus, but instead there was a profuse outpouring of blood. A rubber tube was inserted through the opening in the convex surface of the kidney down to the pelvis. The kidney was stripped of its entire capsule. On account of the anuria, and on account of the cystoscopic findings, it was thought that the ureter was blocked; it was found greatly thickened and collapsed, but not obstructed."

The accompanying table shows the urinary output prior to and following operation, and the blood urea estimations during this time.

URINARY OUTPUT AND BLOOD UREA ESTIMATION

BEFORE OPERATION

Date 1921	Drainage	Voided per urethram	Total (in ounces)	Blood urea (mgs. per 100 c.cm.)
Feb. 20		2	2	
Feb. 21		0	0	
Feb. 22		1	1	
Feb. 23		1	1	
Feb. 24		1	1	75

AFTER OPERATION

Feb. 24	Lost	0	Several oz. (estimated)	
Feb. 25	12	0	12	
Feb. 26	40	0	40	
Feb. 27	37	11	48	54
Feb. 28	47	9	56	
Mar. 1	38	10	48	
Mar. 2	47	12	59	
Mar. 3	44	19	63	
Mar. 4	14	29	43	
Mar. 5	22	27	49	
Mar. 6	29	17	46	
Mar. 7	22	32	54	
Mar. 8	13	64	77	24
Mar. 9	11	47	58	
Mar. 10	Tube removed	54	54	
Mar. 11		47	47	
Mar. 24		Not recorded		13

At the present time, the patient's 24-hour urinary output varies between 50 and 70 ounces, his blood pressure is normal, and he has gained 10 pounds in weight since operation. The urine still contains pus, from which bacillus proteus has been isolated, and a vaccine made, which is being administered. The patient has resumed work, and is apparently in very good condition.

The sequence of events in this case, and the operative findings agree so closely with observations of Watson in his paper on anuria, that they are here briefly quoted:

"When the ureter is suddenly closed, as in the case of calculus anuria, the urinary secretion is very quickly arrested, a small amount only being formed, and accumulating above the point of impaction of the calculus.

"The kidney is enlarged owing to congestion and œdema of the organ which follow upon closure of the ureter, and increased intrarenal pressure thereby produced, and not because of being distended by accumulation of urine within it.

"Progressive destructive changes begin in the secretory elements of the kidney, soon after the establishment of the anuria, and, unless the obstacle be removed, continue, ultimately destroying the entire renal substance by a gradual aseptic process of atrophy if the kidney is not infected, more rapidly by suppuration if it is infected."

We believe that in this case, each attack, clinically pyelitis, with its attendant anuria of varying duration, was in reality a renal colic caused by temporary blockage of the ureter, assuming that such blockage might easily occur by extension from an obstinately chronic bladder infection.

In the three attacks preceding operation, the blockage was so temporary that the kidney did not become congested and œdematous, and shut down. In the last attack, it did, either due to longer urethral block as indicated by the cystoscopic report the day preceding operation, or to summation of insult. At operation, the ureter

was greatly thickened and collapsed, but not obstructed. There was no infection in the kidney.

SUMMARY

1. A purulent urethritis, acquired in some unknown manner, at the age of 3 years, and neglected, resulted in the formation of a urethral stricture, which manifested itself symptomatically at the age of 13 years.

2. Operation for impermeable stricture at the age of 17, followed in 6 weeks by right-sided nephrectomy for hydropyonephrosis.

3. An interval of reasonably good health for 4 years, except for chronic cystitis, followed by 4 attacks of left renal colic, the last culminating in anuria, in which 5 ounces of urine were voided in 100 hours, with the longest period of complete anuria, 35 hours.

4. Impending uræmia, with a blood urea of 75 milligrams, immediately preceding operation.

5. Nephrotomy and decapsulation in a case of single kidney, with prompt re-establishment of the normal urinary output, and recovery.

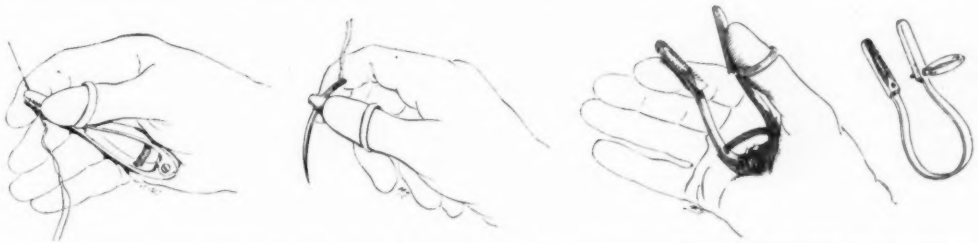
REFERENCES

1. Minningham, W. D. A case of anuria for 23 days, followed by perfect recovery. J. M. Soc. New Jersey, 1908–1900, v, 566–568.
2. Butler. Suppression of urine for 13 days, single kidney; occlusion of ureter by inspissated thrombus; remarks. Lancet, Lond., 1890, i, 79.
3. Tracy, S. E. Recurrent anuria due to calculus which acted as a ball valve in the ureter of a single functionating kidney. Pennsylvania M. J., 1911–1912, xv, 928.
4. Watson, F. S. Obstructive calculus anuria. Am. J. Urol., 1910, vi, 18–29.

AN IMPROVED NEEDLE FORCEPS

By EMMET A. PRINTY, M.D., Chicago

THESE needle forceps were originally designed early in 1917, and the first model was described in the *Surgical Clinics of Chicago*, October 1918, vol. ii, No. 5. Various improvements have been made since then as can be seen by referring to the accompanying diagrams. The new instrument, perfected in 1919, is of heavier and more solid construction, the jaws are narrower and more tapered, and a spring and hinge have been added.



The forceps were originally made to use with straight needles, when doing gastro-intestinal suturing, but the new model can also be used to hold curved needles, especially when suturing the skin. It can be kept on the thumb ready for instant use and does not have to be laid aside when tying sutures. In pulling the suture taut the thread should be grasped between the middle and ring fingers to prevent pulling out the needle. It may be used by the assistant as a needle-puller.

The forceps have a definite field of usefulness, and after one becomes accustomed to them, they are found most convenient. The needle can be held at any angle in the forceps, and with practice the surgeon can hold the needle with them with practically the same ease as he holds the needle between the fingers, with the added advantage that when suturing resistant tissue the needle can be held more firmly and there is not the danger of tearing or puncturing the gloves. The surgeon who has been accustomed to holding curved skin needles in his fingers, upon trial finds that the forceps is most convenient and that he can obtain the same wrist action with it as with the needle in the fingers.

EDITORIALS

SURGERY, GYNECOLOGY AND OBSTETRICS

FRANKLIN H. MARTIN, M.D. ..... Managing Editor
ALLEN B. KANAVEL, M.D. ..... Associate Editor

MAY, 1922

PROLAPSE OF THE RECTUM

IT is very regrettable that the venerable term "Prolapse of the Rectum" is still much in vogue. It retards progress, and in a measure renders futile the search for an adequate treatment of a disease, which, to put it mildly, is nasty and extremely burdensome to the afflicted individual. To the surgeon initiated into the true pathogenesis of the malady, it is self-evident that prolapse of the rectum is only a variety of hernia, and in consequence its treatment must also be based upon all those fundamental principles, which underlie the treatment of hernia in other parts of the body. It is true that there exist certain very definite differences, which render the problem an extremely difficult one, and yet one not without interest and importance.

The writer has definitely shown in previous publications that prolapse of the rectum is a hernia which makes its exit superiorly through the cul-de-sac of Douglas and through that portion of the levator ani muscle, through which the rectum normally escapes from the abdomen to the periphery; this opening may therefore be termed the internal ring of the hernia and is analogous to the internal inguinal ring in an oblique inguinal hernia. In the course of its development, the hernia first invaginates the anterior wall of the rectum into the lumen of the gut, and when it has finally attained full size, it escapes from the pelvis at the anus; this may, therefore, be termed the external ring of the hernia, and is the analogue of the external inguinal ring in an inguinal hernia. Thus far prolapse of the rectum does not differ in its pathogenesis or pathology from any other hernia.

The first notable difference, and it is this feature which renders treatment difficult, lies in the fact that prolapse of the rectum is an exquisite example of that subvariety of hernia, which has received the name of "sliding hernia." It would lead me too far to describe at this place the pathology of a sliding hernia. I will, therefore, merely point out that the important characteristics of this hernia are, first, that it can occur only with viscera, that are only partially covered by serosa, and second, that the hernial contents, are not only hernial contents, but are also used up in the formation of the sac. If prolapse of the rectum is now studied from this aspect of the subject, it is readily seen that this particular form of hernia must be of the sliding variety, because only the front of the rectum is covered by peritoneum.

The second differential point, and one which this hernia shares with sliding hernia in the inguinal region, is the extreme difficulty in the operative treatment, and is furthermore accentuated by the fact that whatever operative measure may be undertaken for its treatment, must be carried out at the extreme depth of the pelvis, enhanced by the addi-

tional fact that, owing to the very presence of a hernial protrusion, the pelvis is of unusual depth.

The final and the most important difference between this and all other herniæ is this: that whereas as a rule in all other herniæ, the hernial coverings are of minor importance, and are ruthlessly discarded, in prolapse of the rectum, they are not only of prime importance, but, so to say, indispensable, because the rectum forms the most important covering of the hernia.

This pathogenesis of prolapse of the rectum can be readily proven at every operation, which attacks the problem in a rational and radical manner. It follows, therefore, that its cure must be based upon those principles which underlie the cure of a hernia in any other part of the body. It follows also that no operation is to be thought of which attempts a cure by a plastic operation upon the rectum, or by such operations, which attempt a cure by suspension of the sigmoid flexure. In fact no operation can be of value, which does not take into consideration the hernial sac, which after all is the most important and underlying element in the pathogenesis of the malady. Here, however, we are confronted with the problem, that the hernia is of the sliding variety, and that therefore, it is impossible to extirpate the hernial sac, as we are accustomed to do in hernial operations. After numerous failures in other directions the writer has finally arrived at the conclusion, that even the extirpation of the sac is not the most important problem. What is more important is its complete obliteration, in such a manner, that hernial contents, viz., small intestines and omentum, can no longer find their way into it. The writer has, therefore, evolved the idea of a complete obliteration of the pelvis, and he does this by circular sutures of an unabsorbable material (Pagenstecher's thread). In order to add additional support, an attempt is made to grasp in the sutures also the subjacent pelvic fascia.

It might be argued that this method of curing the hernia is flimsy, and hardly to be relied upon. In reply it can be stated that the conviction is growing in the minds of surgeons, that even in herniæ in other parts of the body, the adequate handling of the hernial sac is looked upon as one of the most important elements. Additional evidence is gained from the circumstance, that the operation is nearly always curative. At all events the pathogenesis of prolapse of the rectum, as previously outlined, is proven beyond peradventure; and no operation, however ingenious, can ever prove successful unless this pathogenesis is recognized. A. V. Moschcowitz.

INTRINSIC DERANGEMENT OF THE KNEE JOINT

IF a patient dies from peritonitis following a clean abdominal operation his illness has been short. It is the end, the patient is forever out of sight, and regrets are in vain. As time goes on, although not forgotten, details are dimmed and reminders are less acute. If, however, following the opening of a knee joint, an infection occurs, the patient usually lives through weeks and months of suffering and is finally saved, by free drainage with consequent ankylosis or by amputation, to stamp around the remainder of his days, a living, blatant example of a surgical disaster.

Before the days of Lister, the knee joint was looked on as forbidden ground, and this is a heritage that is hard to down. The rare but unfortunate infection of the knee joint that has developed in our modern hospitals, with the patient living and going through a heart-rending convalescence, has but served

to keep alive this distrust of the knee joint as a proper field for surgery. During the great war, ample evidence was presented that the knee joint has an appreciable resistance to infection. The mobilization advocated by Willems, when instituted early, after proper cleaning of the wound and institution of drainage, gave such astonishing results that we could no longer doubt. That the late cases, when infection was deep in the synovia and capsule, did not respond to drainage and motion, by no means disproves the claim. If the surgical technique that is essential to all surgery is observed, one need not fear exploring the knee joint any more than any other closed serous cavity of the body.

The semilunar cartilages rank first as a cause of mechanical derangements of the knee. The English literature contains many reports, notably by Rutherford Morison and Sir Robert Jones, of large series of patients operated on, but the American literature is scanty. This can be explained, partly at least, by the fact that games such as rugby and soccer are participated in by a much larger number of persons than in America, and also by the fact that in the mines in the region of Newcastle, where the condition is very common among the miners, the workers labor in low seams, which makes it necessary for them to squat on their heels with knees flexed and feet everted, a most favorable position for damage to the menisci. The fact that the internal cartilage is more often damaged than the external can be explained by anatomic facts. The internal cartilage is so firmly attached to the internal capsule that when caught between the bones, if the force continues, the cartilage will tear or fracture before it is torn from its moorings.

Rutherford Morison has described in detail many types of fractures but the so-called "bucket-handle" is probably the most common. This specific tear is a longitudinal rip in the middle portion of the internal cartilage, leaving the torn area attached at the anterior and posterior ends, the loop thus formed slipping into the intercondylar notch. Full extension is thereby prevented and the joint locked in slight flexion. A definite pathological condition as evidenced by a tear or fracture is almost invariably present when the derangement is due to the internal cartilage.

The external semilunar cartilage at its periphery is loosely attached to the capsule and this fact permits the meniscus a certain mobility and allows it to glide out of harm's way. If it is the cause of the derangement, it usually is found crumpled up rather than torn and is more apt to prevent flexion than to limit extension. The condition is usually a loose rather than a torn cartilage.

The primary derangements should be treated conservatively but repeated lockings with periods of disability make it necessary to resort to surgery. The X-ray is of no value as these fibrocartilaginous menisci cast no shadows. The procedure of injecting the joint with oxygen, thus throwing the fibrocartilages in relief, is too dangerous a procedure to warrant its use.

Loose osteocartilaginous bodies are also a cause of mechanical derangement of the knee, but the symptoms are more transient and the disability less than when the menisci are at fault. In numbers, they range from one or two up into the hundreds. Usually the patient has palpated them and often is able to force them out where the surgeon can also feel them. They are readily shown by the X-ray. Not infrequently, both joints are involved. They are of chief interest from the view-point of etiology. As a primary premise it may be accepted that trauma, direct or indirect, is a factor but not the sole factor in

their production. They may be grouped under three divisions. They may arise from the internal condyle just anterior to the insertion of the posterior ligament. A satisfactory explanation of this peculiar condition, seen only in the knee joint, has not been advanced, but Koenig, in 1887, offered the theory that it was due to blockage of an end artery and called the condition "osteochondritis dissecans." They may arise incidental to osteoarthritis. The marginal osteophytes or ecchondroses become chipped off and wander freely about the joint cavity and increase in size, obtaining their nourishment from the joint fluid. Occasionally the synovial membrane undergoes a peculiar change, becoming thick and pleated, forming bulbs which become osteocartilaginous on the tips, and, as they increase in size, drop off and migrate as free bodies. They take nourishment from the joint fluid, further increase in size, and may be so numerous that in palpating the knee, one is reminded of a sac of marbles. This condition is called "osteochondromatosis," and is not confined to the knee joint, but may be found in the elbow or shoulder joint. It suggests in some ways a benign neoplasm. Osteocartilaginous bodies rarely arise from the tibia or patella. Loose foreign bodies of extrinsic origin are of very rare occurrence in civil practice.

The incisions to be used in the removal of the causes of mechanical derangement are of importance because the joint cavity is not easily explored. When one of the semilunar cartilages is to be removed, either the internal, anterolateral or the external, anterolateral are to be preferred to any other. When a thorough search of the anterior compartment of the knee joint is to be made, the longitudinal split patella incision is the incision of choice. When the bodies to be removed are in the posterior compartment, the posterior, internal lateral or the posterior, external lateral incisions made with the knee flexed to a right angle afford ready access to a rather inaccessible region and even a fair degree of opportunity for visual inspection.

MELVIN S. HENDERSON.

GLAUCOMA

IN glaucoma, we are dealing not with a disease entity, but rather with a syndrome, the chief feature of which is increased intra-ocular pressure.

The question, "What controls the intake and outflow of fluids in the eyeball and thus preserves the normal intraocular pressure," has not yet been satisfactorily answered. Until this is known we are not in a position to understand why the pressure is increased.

A great deal of evidence has been offered to show that this increase of pressure has an anatomic basis and that it results from a blocking of the lymph circulation through the spaces of Fontana that lie in the pectinate ligament at the sclerocorneal junction. Most of the investigations of students of the subject, such as Weber, Knies, Priestley Smith, and Henderson are along this anatomic line.

Others maintain that the cause must lie deeper and may be looked for in increased secretion of fluids or of altered secretion of fluids by the ciliary processes, and that such increased or altered secretion may be influenced by degenerative changes in the structures of the eye, or may be the result of disordered metabolism. Whatever may be the cause of the increased intra-ocular pressure it is generally recognized that this is the dominant feature of the condition, the most immediate factor in the impairment of the function of the eye, and the one that best accounts for the clinical manifestations of glaucoma. It is, therefore, the one against

which therapeutic attack has been directed, on the assumption that if there is no increased intra-ocular pressure, there is no glaucoma.

The discovery by von Graefe in the middle of the last century, that iridectomy will reduce the tension of a glaucomatous eye has been the means of preventing great suffering and saving the sight of many who, without it, would have become blind.

The value of this operation is seen particularly in cases of the acute or congestive type, in which the anterior chamber is shallow and the root of the iris tends to block the filtration angle. But often the glaucomatous condition persists or recurs after such operation, however skillfully performed and surgeons have found it necessary to resort to other means to promote and facilitate drainage from the eye to maintain the proper pressure equilibrium.

Particularly is this the case in the so-called chronic or non-congestive types of glaucoma in some of which the pressure is not greatly increased, but which may go on rather slowly or insidiously to contraction of the visual fields and ultimate blindness. In these cases ophthalmologists use myotics such as eserin or pilocarpin, hoping by the contraction of the pupil to put the iris on the stretch and draw it away from the filtration angle. Also by this measure the spaces of the iris are opened up and are better able to absorb fluid from the anterior chamber.

If this treatment with myotics combined with general measures suffices to keep the intra-ocular pressure within normal limits, and the visual fields from contracting, operative treatment is by some regarded as unnecessary. But too frequently this proves to be false security, and the tension remains increased and operation becomes necessary. It has been found that in chronic cases iridectomy is not as valuable as in those of the acute or congestive type.

Various methods have been proposed and practised for securing artificial drainage of fluids from the eye and thus lowering its pressure, and the most important of these, aim to accomplish the result by some form of sclerectomy which on healing is supposed to leave a loose meshed scar, the "filtering cicatrix" through which the fluids of the eye will filter away into the submucous cellular tissue of the conjunctiva.

In this class of operations are the sclerectomies of LaGrange (combined with iridectomy), Herbert, Holth, and the trephining operations of Fergus and Elliot. In another class of operations, the attempt is made to insure a cicatrix more permeable to fluids, by incarcerating a portion of the iris in the wound of the sclera, this being covered by the conjunctiva. Such are the operations proposed by Herbert, Holth, and elaborated by Borthen in the operation of iridotasis.

The operation of cyclodialysis, separation of the ciliary body from its attachment to the sclera so that fluids may pass from the anterior chamber into the subchoroidal spaces, excited some attention years ago, but is not practised much now.

Quite recently a new thought has been advanced by Curran that in glaucoma, fluids cannot pass readily enough from the posterior into the anterior chamber, because of the close coaptation of the surface of the iris to the anterior surface of the lens. He endeavors to remedy this by a small iridotomy near the root of the iris; through this small opening the equilibrium of pressure between the posterior and anterior chambers can be re-established.

Indeed the operations that have been proposed for this deplorable condition are so numerous as to indicate that the perfect one has not yet been devised.

WILLIAM H. WILDER.

TRANSACTIONS OF SOCIETIES

CHICAGO GYNECOLOGICAL SOCIETY

REGULAR MEETING HELD NOVEMBER 18, 1921, DR. W. C. DANFORTH, PRESIDING

PRIMARY CARCINOMA OF THE FALLOPIAN TUBE

DR. JOSEPH L. BAER: Mrs. H., age 53, entered the Michael Reese Hospital, on September 27, complaining of backache, frequent urination, constipation, and weakness, which had been present for the last 4 years and had been increasing in severity. General physical examination was negative except for a moderate, bilateral, cervical adenopathy. Bimanual examination showed the pelvic inlet to be filled by a globular mass, of grape fruit size, completely obliterating the cul-de-sac of Douglas. The uterus was crowded against the left superior pubic ramus. Pre-operation diagnosis: solid right ovarian tumor.

At operation the left tube and ovary were found normal. The uterus was atrophic. The right tube was bound down to a hard, white mass the size of a small grape fruit which was fixed by firm adhesions to the pouch of Douglas and to the posterior abdominal wall. The left tube and ovary were left *in situ* and the tumor, uterus, right ovary, and tube removed. The removal of the tumor was quite difficult, there was considerable bleeding, and a large denuded area was left in the pelvis. The sigmoid was used to block off the pelvis. Microscopic diagnosis made by Dr. Oscar Schultz: primary carcinoma of fallopian tube. The patient made an uneventful recovery and left the hospital in 14 days.

DERMOID CYST EXPELLED FROM RECTUM DURING LABOR

Mrs. F., age 25, III-para, admitted in labor. Patient had had one normal and one instrumental delivery. After the cervix had been completely dilated for 1½ hours and no progress was evident, the head being deeply engaged, forceps delivery was done. While extracting the head, a free mass the size of a man's fist, fell out through the anus. No rectal bleeding followed. The puerperium was entirely uneventful without any temperature elevation. The condition was encountered in a rather difficult forceps extraction and after getting the head down on the pelvic floor, I thought that there would be no further trouble, and went ahead with the extraction. The anus began to dilate when, to my horror, the whole rectal wall apparently began to show and prolapse. I had visions of a complete avulsion of the rectum prolapsing through the sphincter, but the perineum was intact, so I went ahead and the advancing baby's head continued to push this mass through the anal sphincter. Finally it proved to be a smooth-surfaced tumor which, in another moment popped out of the anal opening fully detached and free. It was a tumor of man's fist size, which proved to be a dermoid cyst with a little roughened surface at one point which was evidently the place of its attachment, somewhere. The patient made a normal recovery without evidence of traumatism along the lower bowel. The problem arises whence the dermoid. Dr. Schultz finds that the microscopic picture bears a resemblance to a dermoid of the ovary. Whether this was a sacrococcygeal dermoid which for long years had eroded its way through the posterior rectal wall and, after permitting two children to pass, was forced out by the delivery of this third child, whether it was an erosion into the intestinal canal higher up, or whether it presented an embryological cyst of the recto-vaginal septum I do not know. I came into the case when the head of the child was deeply engaged. Bimanually it was not revealed; there was no rectal prominence at all comparable to this apple-sized mass.

This complication is unique in my experience and in my reading, nor have I found anyone in the society or outside of it who ever encountered it before. Dr. L. E. Frankenthal has called my attention to a case reported in a recent number of the *Zentralblatt fuer Gynaekologie*, in which a fixed sacrococcygeal dermoid was an obstacle to delivery and was surgically removed to permit labor to be completed.

DISTURBANCE OF OVARIAN SECRETION, A PROBABLE CAUSE OF DEVELOPMENT OF HÆMORRHAGIC TENDENCY

Dr. ARTHUR H. CURTIS: Very recently I operated upon a young woman of about 30 who had two chocolate-colored cysts of the ovary; one the size of a fist, the other four or five times as large. There was almost no ovarian tissue left in the cortex of these cysts. This patient had been under the care of Dr. Oliver S. Ormsby for more than 7 years. Every time the cutaneous surfaces of her body were bruised, ever so slightly, she developed a hæmorrhagic area, at times as large as a saucer.

The question arises as to whether the disturbed secretion of the ovary is an essential factor in the

development of the hæmorrhagic tendency. I wish to ask whether other members have encountered similar dyscrasias which might be ascribed to disturbances of the ovaries.

COMPLETELY CALCIFIED OVARY

This specimen was taken from a colored woman of about 44 years. The patient had a mass of fibroids the size of a child's head. On rectal examination, the mass was thought to be a calcified fibroid nodule, but upon opening the abdomen it proved to be a completely calcified ovary. The ovary was composed entirely of bone, was hollow in the center, communicated with the large bowel, and was filled with débris.

DIFFUSE ADENOMYOMATOSIS OF THE UTERUS

This second specimen shows a diffuse adenomyomatosis of the uterus. The uterus is about three times the normal size. Sections made at random invariably yield acini of glandular tissue.

FOUR CASES OF NEPHRECTOMY FOR VARIOUS LESIONS

DR. W. C. DANFORTH: These four cases are shown, not because any of them represents anything of outstanding interest, but merely to emphasize the fact that in any service in which numbers of women are treated there are found at frequent intervals lesions of the urinary tract, and that it is the part of wisdom to be on the look-out for urinary pathology.

The first specimen is an enormous pyonephrosis. This woman was operated upon about a year and a half ago in a small town in Iowa, at which time a subtotal hysterectomy was done. At this operation the left ureter was evidently tied off, as upon cystoscopy I found it entirely impermeable from a point 3 centimeters above the vesical opening. When she arrived, the mass was so large that I did a nephrotomy for drainage to decrease its size, obtaining a considerable amount of purulent material of syrupy consistence from which we were not able to obtain any growth upon culture. Six weeks later, nephrectomy resulted in obtaining this very large kidney which was so densely adherent that in excising it, a hole was torn in the diaphram which was repaired immediately without apparently influencing the convalescence.

The second specimen is a large tubercular kidney containing many pus cavities. It was removed from a woman who, up to the time she was referred to me for diagnosis, had presented no symptoms whatever except a slight increase in frequency of urination which had been refractory to ordinary treatments. Cystoscopy showed the presence of many small tubercles and a catheter could not be passed up the left ureter. The right ureter was normal, the urine from the right kidney was normal. Tubercle bacilli, however, were found in the bladder urine which we assumed, therefore, must come from the left kidney. Nephrectomy was done by Dr. William R. Parkes, at whose request I did the cystoscopy.

The third specimen comes from an old woman who came to the out-patient department of the hospital because of frequent urination. Pelvic examination was negative and she was sent into the gynecological service for cystoscopy, the mass in the left kidney having been overlooked until that time. She was transferred to the surgical service for operation and a large carcinomatous kidney excised by Dr. Parkes.

The last case is that of an elderly woman physician living in a suburb west of Chicago and referred to me. Twenty-four years ago an enormous stone was removed from the left kidney, by Dr. Charles Adams. Ten years later nephrotomy was done, at which time two large stones were removed and the kidney drained. When she came to the hospital she had a large pyonephrosis and X-ray showed the presence of two enormous stones. We have, therefore, a formation of enormous stones in the same kidney in the same individual three separate times in 24 years. I have had one other instance of formal tion of a stone of walnut size one year after removaof a stone from the same kidney.

CHILDBIRTH—PRIMITIVE VERSUS MODERN

DR. C. HENRY DAVIS, Milwaukee, Wisconsin, read a paper entitled: "Childbirth, Primitive vs. Modern" The paper was followed by a lantern demonstration showing labor scenes from Dr. Englemann's *Labor among Primitive Peoples*, and others to demonstrate modern delivery room technique as employed by the writer. (See p. 636.)

DISCUSSION

DR. DE LEE: I think that I ought to say a word or two on certain points, upon which I have always laid the greatest stress. My book distinctly instructs doctors and nurses that they are to disinfect the skin of the abdomen and the perineum thoroughly, but it must be definitely understood that only the immediate area around the vulva is to be considered aseptic. I consider this advice very important. If an infected surface is covered with one or two layers of cloth some surgeons think that they can then, with impunity, handle that sterile cloth. Two layers of cloth will not filter germs from an infected surface underneath, certainly not if wet.

For illustration, if you will magnify a piece of sheeting to the same degree of magnitude that will enable you to see a bacterium or coccus, you will see that it looks very much like chicken wire, and a germ will go through the interstices of the cloth as a fly will go through the chicken wire. You do not need a picture to prove that. And it is especially true if there is only one or possibly two layers of cloth.

Now, if those two layers of cloth are wet, then the capillary effect, or capillarity, will draw the germs through from the infected surfaces. Therefore, the

coverings of the legs, although sterile when put on, are not considered aseptic, and the only part that may be touched with safety, is the part immediately around the vulva, and the sterile towel over the belly which is frequently changed.

Regarding the covering of the anus we know that during delivery, the discharges from the anus sometimes come out with great force and if you put one or two layers of sheeting over that region, and then expect to handle the surface, you are running great danger of contamination from the anal discharges. Even with impervious rubber sheeting it is dangerous.

I have tried every method to protect the field against infection from the anus and find none that is entirely satisfactory. I believe that the best method is to watch the anus constantly and to catch the discharges.

The society may remember I have always held that childbirth is a pathological function. No one in his right mind would contend that pregnancy is a disease, but no one can deny that pregnancy and labor leave changes in the woman, and often the child, that are distinctly pathogenic. They are pathogenic and therefore pathological, and, in order that the people, the medical profession, and our legislators should give the science and art of obstetrics its proper place, it is necessary that every one should recognize the pathological dignity of this function.

That obstetrics has so far not attained the place in the general esteem it deserves may be learned from the paper of Dr. Davis. In 1835 Ramsbotham complained that he was not allowed to become a fellow of the Royal College of Surgeons of London, and a member of that College would not dare to be seen shaking hands with him on the street. As a mark of extreme courtesy to him because he was such a good and much sought after obstetrician, Ramsbotham was invited to witness a cæsarean section performed by one of the famous London surgeons. Fate would have it that the surgeon failed in his effort to deliver the child, and he had to call on Ramsbotham to turn and deliver it, whereupon the surgeon completed the operation.

Even today the obstetrician does not rank with the surgeon in the minds of the public nor will he until the full pathological dignity of obstetrics is recognized.

Dr. Rudolph W. Holmes: Dr. Davis mentioned that Philadelphia was the first American city to have obstetric teaching, which is true as far as systematic instruction is concerned, though the first full professor of obstetrics was Dr. Tennant of King's College, now Columbia College. Buffalo has the credit of being the city first to have clinic instruction. In 1759, James P. White gave the first clinical instruction before his class. He found a poor forsaken woman who had lodged with the janitor's family in the college building. Professor White was severely arraigned for the *indecent* exposure by members of the profession and the daily press. In the suit for libel instituted by White the defense had medical witnesses who maintained that no knowledge was acquired by the students from the exhibition, that the time for a doctor to learn obstetrics practically was when he entered practice. One testified that students watching a hen lay an egg could learn as much as watching the head come over the perineum.

Another thing: Doctor Davis made the statement that the sensorium of the modern obstetric woman has changed over a former period. I cannot accede to that. After reading the past literature covering obstetrics these last three or four centuries I doubt that a critical reading can substantiate the statement. Going back to *Genesis* we find that women bring forth their young in travail and pain; travail is not merely pain but excruciating pain. When we come down to more modern times, all the dissertations pro and con, concerning the use of chloroform in labor, by Simpson, shows that in spite of what one or the other said women suffered severely in the throes of labor. You know that Hodge and Meigs combatted the use of anæsthesia, at that time by the bald statement that the pains of labor were physiological and therefore had no necessity for their relief. The fact that Queen Victoria, the titular head of the Church of England, had chloroform employed when princess Charlotte was born did more to popularize the use of the drug than any other single factor. In more recent times, nothing has been written for or against the use of "twilight sleep" or the really scientific employment of nitrous oxide-oxygen, but what is merely paraphrasing the acrimonious debate centering around Simpson in 1847 when he began the use of chloroform. It hurts now to have a baby, and history shows that it always has done so. Some women have more fortitude than others but pain is there nevertheless.

Further I question if there has been any structural change in the anatomy of women going back to the beginning of time. I am not referring to changes incident to disease, as rickets or joint luxations, but purely in biological development. Of course, stature of different peoples show marked deviations of pelvic size, but as the infants born from peoples who are small are small there is no dystocia. Some time ago, in talking with a Philippino physician, he made the assertion that dystocia is relatively infrequent.

The rite of circumcision has been practiced for thousands of years, and yet the rite has had no influence on the biological development of the prepuce, it is just as redundant today as it ever was.

Dr. Taussig recently informed me that there is nothing to show that the conformation, or development, of the hymen has altered so far back as knowledge goes.

With the two above analogies I believe there is no scintilla of truth in the too oft repeated assertion that women today have more difficulty or more pain in labor than formerly, if we judge of normal women, not those suffering from acquired distortions from disease.

Dr. Thompson: I would like to add a few remarks in regard to obstetrics among primitive people. I

have had some experience in examining the women among the Ojibway Indians in northern Ontario. I have never seen a woman confined, but I have talked the matter over with the parish priests and they say that a full blooded Ojibway in northern Ontario never puts off a journey for childbirth, that they simply stop and have the baby by the side of the lake, put it in the canoe, paddle along and join the others. Injuries such as are known among the civilized people are scarcely heard of among those primitive people.

The mixed bloods are the ones that have the obstetrical injuries and diseases. When I used to go north on my summer journeys, an old halfbreed woman who was the Godmother or mid-wife to practically all the tribe in that country used to ask me every season if I would see a lot of the poor women that she had gotten together, knowing that I was coming to make a canoe trip, and we would examine these women who had obstetrical injuries just as we have in civilized communities. They had laceration of the perineum and cervix and injuries of the pelvic regions. I have never found these conditions in the full blooded indians. It has always been the case that the injuries were among the half-breeds, but the full bloods were peculiarly free and they were much more healthy and seemed to recover much more quickly after lying-in.

DR. CAREY: I should think it would be objectionable to cover up the rectum with sheets in the manner Dr. Davis speaks of, for it is impossible to keep the patient lying quietly during delivery and as during parturition there is more or less discharge of mucus from the rectum, I should think it would be impossible to keep the sheet from rubbing against the rectum and then up over the field. I would much prefer to have no sheet over the field.

DR. BAER: Just a word in defense of the lateral position for delivery, which is our routine at the Michael Reese Hospital. We believe that exposure of the anal field lends itself much more readily to protection of the birth canal than any attempt at burying the anal orifice under sheeting or packing with cotton, the discharges from the anus down under the buttocks. Furthermore, we believe that we are better able to watch and guard the perineum and control and manipulate the head, with lateral posture than in the dorsal position as advocated by Dr. Davis.

DR. E. CAREY: I think, in defense of Dr. Davis' statement as to the more difficult labors in the present day, it is known that the mixing of the nationalities will increase the size of the head. It has been definitely shown that the Japanese who are about the only pure blooded race left in the world, very seldom, if ever, have any laceration. The pure blooded Marquesans also have very little difficulty as a rule. They usually take the baby immediately down to the river and wash it as soon as delivered; afterward plunging in for a swim themselves.

Regarding sheeting or the use of emergency draping, as Dr. Davis describes, I have found that it goes very nicely in emergency cases, but if there is anything to be done the sheet becomes contaminated with fæcal matter and moisture from whatever source, and as the patient moves the knees up and down, matter is smeared over the vulva.

Regarding the use of vaseline, I do not believe it is good technique. The perineum lying next to the anus, is more or less infected. If the perineum is covered with vaseline or glycerine the patient will perspire freely and bacteria may be forced with the perspiration into the vaseline, and the examining hand introduced through that vaseline into the vagina will undoubtedly cause some of this vaseline to adhere to the inside of the vagina, and this may lead to infection of the birth canal.

DR. DAVIS: I appreciate the points brought out in the discussion of my paper. As regards delivery-room technique it should be remembered that my patients all have obstetrical analgesia and with rare exception lie quietly and do as they are told during delivery. The surgical cleansing is accomplished when the head is on the perineum. After the perineal area is cleaned, the pores of the skin are sealed with sterile glycerine as a rule, but vaseline or liquid soap may be used. The abdomen is covered with a sterile towel, and sterile towels are fastened around the thighs above the perineal stockings. The hips are elevated about 6 inches with the inclined hip rest for the perineal stage of labor. This is my first material deviation from the usual technique described by Dr. De Lee in his textbook. When the head is on the perineum I add the sterile sheet which is draped over the thighs and pressed down to expose the vaginal opening. It does not come in contact with the perineum at this time. A primary posterolateral episiotomy is now made. The sphincter ani is already dilated by rectal examination. I favor episiotomy for most primiparæ and multiparæ who have not been neglected following former labors. Formerly I used the medium episiotomy but following three complete tears, one with a persistent posterior and two with rather large aftercoming heads concluded it was safer to direct the cut somewhat to the left side of the sphincter. The complete tears were repaired at once with perfect results in two cases and fair in the third.

My patients are given a light anæsthesia with nitrous oxid oxygen for the episiotomy and a deep analgesia for delivery of the head. Ether is added when indicated. The deep analgesia is used for most mid and low forceps deliveries. The episiotomy is repaired under a gas-ether anæsthesia. I bury plain catgut and close the mucous membrane and skin with chromic catgut. In a few cases black silk is used for the skin. When care is used to avoid dead spaces and strangulation of tissue from drawing the sutures too tight, there should be a perfect restoration of the perineum.

Could Dr. De Lee or Dr. Carey see a patient delivered under obstetrical analgesia with this technique, I believe they would agree that when the patient is quietly working according to directions,

my changes in technique are not open to the question they have raised.

With Dr. Holmes, I agree that childbirth has always been accomplished after more or less suffering. Even the lower animals show mute evidence of suffering during parturition. Yet the modern woman through mixing of races has a harder time with an increased amount of dystocia. Dr. Thompson has emphasized this from his observations of the Northern Indians. It has long been recognized that an Indian woman pregnant by a white man is apt to die during labor unless assisted by a medical man. Furthermore, women of today are less able to stand the nervous shock of labor pain, and I believe we must do everything possible to control and alleviate this pain.

HYPEREMESIS GRAVIDARUM

DR. CHARLES E. PADDOCK read a paper entitled: "Hyperemesis Gravidarum." (See p. 633.)

DISCUSSION

DR. J. L. WILLIAMS: A quantitative study of the chemistry of the blood in hyperemesis gravidarum reveals a marked increase in the concentration of uric acid. In addition to the seven patients previously reported before this Society there are five others with a true pernicious vomiting of pregnancy in whose blood the uric acid was in high concentration, the average amount being 6.34 milligrams per 100 cubic centimeters during the period of maximum toxæmia. The maximum and minimum range was 10.15 to 4.14 milligrams per 100 cubic centimeters. In three of these patients the values dropped to normal after delivery and in one which Dr. Paddock has reported tonight the amount of uric acid in the blood returned to normal following the treatment as outlined although the concentration in the blood of this patient was the lowest of the group. One of these patients, whose symptoms were very pronounced, had a marked retention of non-protein nitrogen substances other than uric acid in the blood. At the period of maximum toxæmia in this patient, the blood urea nitrogen was 107.75, the total non-protein nitrogen 147.4, the uric acid 10.15, the creatinine 3.8 milligrams per 100 cubic centimeters. After therapeutic abortion was performed, the values for all of these substances promptly returned to normal. In another patient the uric acid and other waste nitrogen products were markedly diminished several hours after the intravenous injection of corpus luteum extract.

The outstanding fact that delivery or operative removal of the uterine contents is followed by a return to normal of the concentration of the uric acid of the blood suggests the possibility that by absorption the amniotic fluid may be the source of the increased amount of uric acid in the maternal blood. The amniotic fluid of the patient whose blood contained such a high concentration of waste nitrogen, had 30 per cent more uric acid in it than had the maternal blood.

In all patients with true pernicious vomiting there is a moderate acidosis as evidenced by the depression of the alkali reserve below the level for normal pregnancy. In starvation there is said to be an acidosis clinically. I have examined the blood of one patient dying of starvation caused by duodenal carcinoma and it contained only a moderate increase in waste nitrogen and 4 milligrams of uric acid per 100 cubic centimeters.

DR. MILTON M. PORTIS: I have had a very limited experience in the treatment of hyperemesis gravidarum. I have seen an occasional case, and the particular case that Dr. Paddock mentioned is one that I followed more closely in detail. In my work, of course, I have seen a great many cases of vomiting. The vomiting in some is due to intestinal obstruction, and they are given immediate surgical treatment. But in the majority of cases the vomiting is not due to a surgical condition and these it has been my lot to treat.

In the early days we used rectal alimentation but it was entirely unsatisfactory after the first few days. The bowel does not absorb but a very few things. It will take water in quantities; it will take glucose and alcohol. But beyond that, if you are at all interested in studying your cases given nutrient enemata, you will find that you get back practically all you put in the bowel.

We worked a good many years in trying to get around this but without success. When Einhorn brought out his duodenal tube in 1909 I, for one, hailed it with a great deal of joy. It had solved a big problem and I do not know of anything I have seen of greater value. The first work done with it was, however, very difficult. Einhorn fed with a little syringe that sometimes worked and sometimes did not. At last I modified it and tonight I will show you an improvement I have been using for the past 7 or 8 years that I think is a better type for feeding. It is simplified very much from the feeding standpoint and from the nursing standpoint. It is not a very difficult thing to learn, but it does require some good technique. There are a lot of tricks you have to learn to be entirely successful. The patient doesn't like it and you have to get the patient's confidence. But all the patients, when they get the prompt relief from the vomiting and nausea and begin to feel that they are being fed, would rather have the tube down than to have it out.

I remember the patient that Dr. Paddock mentioned, who asked to have the tube put back in again when her symptoms returned. And I have known that to be true in a number of cases.

I won't take up any time in talking about the various theories of the etiology of hyperemesis gravidarum. There is no doubt in my mind that there is a great big psychic element in this trouble. I am convinced of that from the type of patients we see, and from the results obtained in giving the patient something out of the ordinary. But, as Dr. Williams has said, there is a definite blood change found in a number of cases, and that the patient can

not imagine. There is no doubt at all that there are changes in the blood chemistry in the patients I see without pregnancy who go on vomiting and become dehydrated and more or less weakened by the lack of food. Whether this toxic picture is due to the demonstrated blood changes I do not know, but the fact remains that we lose patients who are not pregnant if we allow them to go on with just the type of thing you see in pregnancy.

I remember very well, in the days before we had the duodenal tube, a healthy young woman of 16 years, with a peptic ulcer, who went on vomiting in spite of all the measures we used. I have never forgotten the desperate days we had in trying to feed that girl and in trying to keep her from dying. In her case the urine was perfectly normal at the start.

With your permission I will ask Dr. Sidney Portis to demonstrate the apparatus we use and explain the details.

Dr. Sidney Portis: For ordinary purposes of inserting the duodenal tube a patient must have a fasting stomach of 12 hours' duration. The tube is inserted back into the pharynx. The patient is told to swallow a little cold water and at the same time use gentle force to aid the swallowing of the tube. This swallowing is kept up until the "stomach mark" on the tube is reached. One may experience some difficulty at first, not only in the initial passage, but while the olive is going down. In order to overcome the "gagging" sensations the patient is told to take deep breaths and thus overcome this difficulty.

The patient is now told to lie on the right side and very gradually swallow the tube to the "duodenal mark," and then to continue to swallow until the mark designated on this tube, which will put the olive way beyond the duodenum. This little stop cock is closed and if the patient has an empty space from an extracted tooth, the tube is fastened into it by means of dental floss. If there is no empty space then the tube is fastened behind the last upper molar and the protruding end fastened to the cheek by means of a piece of adhesive. A string is attached to the stop cock and by means of a safety pin it is fastened to the patient's gown.

The patient continues to lie on the right side the rest of the night to facilitate carrying the olive on downward into the small bowel. The next morning, with the aid of a large Luer syringe a small amount of air is put into the tube in order to expel small plugs of mucus. Then by means of gentle suction the duodenal contents are aspirated.

If the tube is in the duodenum or beyond, a light yellow to whitish fluid is returned, which shows an increased viscosity when dripping from the tip of the syringe. If the fluid comes back very readily and it is thin and contains mucus, it has been my experience that it is in the stomach. The duodenal contents are much thicker and usually bile-stained. If one is still not certain the tube is in the duodenum, the patient may swallow a small amount of milk, and if the milk does not return the olive is not in the stomach.

With the tube in place the feedings may be started. As a matter of routine, before and after the feedings, two syringefulls of water followed by one of air are inserted in the tube. This will insure the patency of the tube and olive.

By means of this thermos bottle and Murphy drip apparatus, the feedings are given over a period of 20 minutes or more. In order to insure that there are no curds of milk after peptonization, the fluid is strained through several layers of gauze. The milk is then diluted with an equal amount of water, so that it flows very readily. The feedings are kept up every 2 hours.

One may also give medication by the same route. This feeding is kept up as long as deemed necessary and then the tube is gently withdrawn. When the olive again reaches the pharynx the patient makes a swallowing movement and the tube is quickly "jerked" out. This causes less discomfort to the patient.

Dr. Milton M. Portis: I am glad Dr. Bacon mentioned the fluoroscope. It should be used when there is any doubt at all. By putting a little barium through the tube you secure the best results. As the barium comes out you can see it in the bowel. If it comes into the stomach it spreads over such a large surface or area that you can determine where it is without question.

I did not want to give the impression, and I do not think my brother did, that there is any discrimination as to what should go through that tube. You can put in anything you want to. Give as much of the carbohydrates as you choose, or glucose or anything else you want. All types of medication can be put through the tube and you can give fruit juices in any amount; laxatives from milk of magnesia to castor oil; or anything you choose may be given. The patient does not taste it. You can give anything you want so long as it is in liquid form and easily pushed through.

Dr. De Lee: A year ago Dr. Paddock told me about the duodenal tube feeding and since then I have used it in three instances. In two of the cases we were successful in getting the tube beyond the pylorus, but the toxic condition of the woman continued and we had to empty the uterus. One of the women received enough fluid through the tube so that she became œdematus. That showed us that we could introduce large amounts of fluids by means of the tube, but in spite of the introduction of the fluid and food, the toxic condition continued and the woman very nearly lost her life.

The second case was a physician's wife. The tube remained in place for 24 hours. We gave her plenty of fluid and food but she vomited alongside of the tube. We used the tests Dr. Portis makes and believe that the tube was in the duodenum.

In the third case, Dr. Portis had an opportunity to pass the tube but he couldn't get it through the pylorus, and the nurse under his instructions, which were carried out to the letter, likewise could not get it beyond the pylorus.

Nevertheless, I doubt not that this is going to be a very great addition to our future handling of ordinary vomiting in pregnancy. It has the double advantage of the psychic influence and also the supplying of food, but the toxic cases will go on to death in spite of these.

I had one very sad experience lately, in which we fed the woman for several weeks. We were under the impression that she was improving because her vomiting was reduced, and she showed signs of gaining. She had plenty of liquid and her weight was not being very much reduced. Her blood picture on several instances was normal, and yet the toxæmia continued in spite of these very favorable signs. All of a sudden, she took a turn for the worse, developed an acute polyneuritis and died in 3 days. Her alkali reserve was good, her water balance good, and she got enough calories to keep up strength and they were sufficient to keep her alive, but in spite of all that, the toxic condition continued. Therefore, I would add a little word of warning in the use of these remedies, which in a way, blindfold us to the actual toxic state underneath.

DR. N. SPROAT HEANEY: First, I should like to ask Dr. Paddock if the nausea disappeared along with the vomiting upon the introduction of the tube, or whether the nausea persisted with the use of the tube.

I fear that we are liable to make certain deductions from the blood chemistry in these conditions which are not justified.

Dr. Williams has mentioned that in these cases of pernicious vomiting the uric acid concentration is high. He also stated that in a case or two where the pregnancy was interrupted, the uric acid concentration of the amniotic fluid was also high and suggests that there is a relationship between these two conditions. Dr. Williams also mentioned that in the cases of Dr. Paddock's in which the patients were relieved by the use of the duodenal tube, the uric acid concentration of the blood fell to normal. Dr. Portis states that in his cases of neurotic vomiting where there is no pregnancy at all, the uric acid concentration is also high, while Dr. Williams states that in a case dying from stricture of the duodenum, the uric acid concentration was unchanged.

Now I deduct from these facts that the uric acid concentration of the blood may be secondary instead of a primary condition, and is dependent upon the fact the patient is in a starving condition from vomiting and that the acidosis and blood chemistry picture are dependent upon this fact and not upon the fact that the patient is suffering from an intoxication of pregnancy *per se*. If a patient comes almost to the point of death from vomiting when she is not pregnant and has the same blood chemistry as a patient with hyperemesis gravidarum *in extremis*, we certainly could not say that a placental condition produced the uric acid concentration. If the blood chemistry is altered, we would also expect all the fluids of the body to be altered, and therefore it seems natural to expect that the amniotic fluid would also have a high uric acid concentration. I am not sure, but I suggest that we may learn that the blood picture is a condition secondary to the vomiting instead of being associated with the cause of the pernicious vomiting.

Not of scientific importance, but of the very highest clinical importance is the fact that for the last few years the only cases of hyperemesis gravidarum that I have seen have been in doctor's wives and in nurses.

DR. SEIPEL: Several years ago I had an acute case of hyperemesis gravidarum and in looking up the literature I came across an article by Dr. Werthein in which the hereditary influence was mentioned and on that point I want to bring out a feature in my patient's history. Her mother had been pregnant six times, and in each case there was a very severe case of hyperemesis gravidarum.

DR. BACON: We cannot get away from the discussion of the cause of hyperemesis gravidarum, but it is questionable, of course, whether the chemical study of the blood may lead us to some better knowledge of it than we have now. A few years ago J. Whitridge Williams thought that he could determine the toxic cases by finding the ammonia coefficient. Now we know that a high ammonia coefficient may result from starvation.

And so, with the present condition of the etiology it is evident that besides treating the patient psychically and symptomatically, the one thing to do is to feed the patient. It is unfortunate that we cannot succeed in feeding the patient by rectum in every case. No doubt, very much can be done by proper rectum feeding by the use of only those substances that are absorbed from the rectum such as glucose and alcohol and not trying anything else, and by proper treatment of the rectum and by using local sedatives, if necessary.

But, if we can, by the use of the duodenal tube get liquids and even those two foods, glucose and alcohol, into the system we are doing very much and we do not have to bother for a few days at least, with milk or anything else, and it seems to me that it would be better as a point of technique to adhere simply to foods that would not stop up the tube.

I can hardly understand why, in a desperate case like this you would care to give very much more than that to the woman. Evidently the technique is very important. I have talked with Dr. Smithies who has used the duodenal tube a good deal and he informs me that he succeeds very often, when the introduction of the tube is difficult by using orthoform in the stomach and producing a partial anæsthesia which assists in the introduction of the tube. Moreover he also determines the presence of the tube by the use of the flouroscope, and I suppose that would be an important part of the technique.

DR. E. CARY: In discussing this question, etiology seems a little out of form this evening; however, unless the treatment is considered from a sound etiological view-point, it needs must fail in its ultimate aim.

Lockhead and Cramer, as far back as 1908, pointed out that one of the chief functions of the placenta is to store glycogen and that most of the fats formed in the fœtus are derived from that source.

Mottram, in 1909, found a glycogen deficiency in the livers of ill-nourished, pregnant animals, and in 1921, in the *Lancet*, Harding states that the causative factor in vomiting of pregnancy is a lack of sufficient glycogen in the liver, or, in short, a carbohydrate deficiency which he has proved results in a fatty infiltration of that organ.

This carbohydrate deficiency, as pointed out by Woodyatt in his exhaustive work on diabetes, interferes with the combustion of fatty acids and results in the production of acetone bodies and an acidosis. Silberstein, of Munich, in 1912, and Blodgett, of New York, in 1915, called attention to the acetone found in the urine of children suffering from cyclic vomiting, and Grulee, of Chicago, states that this condition may best be combated by feeding large quantities of sugar. Chalfant, in 1912, also noted that the liability of vomiting in postoperative cases was increased if acetone were present in the urine.

Constipation tends further to embarrass the liver by adding more toxins, and Alvarez, in 1919, has shown by X-ray that plugging of the lower bowel produces reverse peristaltic waves that reach even to the stomach and œsophagus.

Now, in order that our treatment in vomiting of pregnancy may be founded on rational principles, we must consider primarily, a carbohydrate deficiency, an acetonæmia, an acidosis, and constipation. Harding has shown that fatty infiltration of the liver in laboratory animals has followed relatively short periods of starvation and considers this of paramount importance.

For centuries the vomiting of pregnancy has been termed "morning sickness" and this in itself should be significant. Why is vomiting so prone to occur in the early morning? Because it is a time immediately following the longest fasting period of the 24 hours and when the depletion of glycogen in the liver is greatest.

Therefore, the most logical treatment, it would seem, would be to supply an abundance of carbohydrates in the diet several times a day; neutralize the acid condition evident by urinalysis and correct the constipation. This I have endeavored to do in my cases with signal success.

DR. MCKEE: Dr. Paddock did not mention the severe vomiting that continued throughout the pregnancy in the patient who happened to be my wife. The vomiting commenced 10 days before the first period was missed. That answers in part Dr. Heaney's suggestions as to the neurotic element. Another point, the nausea was not relieved with the relief from vomiting in this case. It was the last thing to disappear. However, at the present time the more frequently the patient eats the more comfortable she is and she is in better condition now than she was during the first pregnancy. In other words since she has recovered from this severe siege she has continued to improve. At the time of delivery the patient weighed 90 pounds but soon reached 145 pounds, showing how rapidly she recovered. I do not know whether it has any bearing whatsoever on the subject but at present the patient voluntarily chooses sweet foods and digests candy with the greatest degree of comfort.

DR. PADDOCK: I hope I made it clear that the duodenal tube is of great benefit in the treatment of many cases of hyperemesis gravidarum, perhaps not in every case. With the tube well into the duodenum there will be no vomiting and I am sure that in the case reported by Dr. De Lee the tube had not passed the pylorus.

There are, undoubtedly, cases of severe vomiting in pregnancy which only the termination of the pregnancy will stop and possibly that treatment will not succeed. Loss of weight with dehydration of the tissues is a warning sufficient to put the physician upon his guard that the case is becoming a very serious one. Do not wait until all other treatment has failed and the patient is in a desperate condition. The tube can be retained for days or weeks with no discomfort to her. Dr. Portis has told you how simple it is to pass the tube and the kind of nourishment to be passed through the tube.

To one of my patients we gave during the first 24 hours 86 ounces of nourishment, mostly peptonized milk and glucose. The next day she took 108 ounces of the same, with the addition of egg.

Every recognized treatment for hyperemesis gravidarum has been tried in each of my reported cases before resorting to the use of the duodenal tube and in each of these cases had I followed my usual procedure I would have emptied the uterus. One of the patients was in such bad condition that I am sure had I done so I would have lost her. Even when the cause for the vomiting has been removed, as for instance the correction of a retroverted gravid uterus or any mechanical irritation removed, duodenal feeding may be of great service in quickly overcoming the dehydration and starvation.

I am sure we have in the use of this agent a valuable addition to the other means of treating our cases of severe vomiting in pregnancy.

BOOK REVIEWS

A CRITIQUE OF NEW BOOKS IN GYNECOLOGY AND OBSTETRICS

By GEORGE GELLHORN, M.D., F.A.C.S., Saint Louis

HERO worship is, in a way, a wholesome thing. It inspires the young and it stimulates the mature. As a nation, we Americans have all too little of it. We criticize our leaders while they are alive, and we forget them as soon as they are dead. Washington and Lincoln are notable exceptions; but who thinks of Hamilton or Grant, who speaks of the man who invented the cotton gin, who built the first locomotive, who constructed the first steamboat? Among physicians the memory of medical heroes is pitifully short-lived. Since we have transferred our instruction to students almost altogether from the lecture room to the bed side, there is no time to dwell on the evolution of our science, and where is there in our universities a chair for teaching the history of medicine? It would be an interesting, but probably a disappointing experiment to inquire from a group of physicians what Ambroise Paré had done to achieve immortality; what we owe to a Harvey, a Virchow, a Koch, a Pasteur; why mankind is in debt to Oliver Wendell Holmes and Ignaz Semmelweis. In the absence of systematic teaching of history in medical schools, essays or books on historical subjects fill a real need and should receive a hearty welcome. This applies pre-eminently to a new book by Schachner which is devoted to one of the greatest among our medical heroes, to Ephraim McDowell,[1] whom America proudly shares with the world. The author has set himself the task of protecting from indifference and oblivion the memory of that courageous practitioner in the small frontier town in Kentucky who, in 1809, performed the first ovariotomy and thereby ushered in a new era of surgery. If we consider that the most brilliant exhibition of surgical skill and judgment of today rests upon the cornerstone daringly laid by McDowell more than a hundred years ago, we must needs applaud the author's desire to establish in the hearts of the medical profession a proper appreciation of this great benefactor of the human race. Patient and painstaking investigations which show clearly that they have been a labor of love, have enabled the author to present the life and work of his hero in greater completeness than it has ever been attempted. Sidelights upon general and medical conditions of the times prove to be most interesting, and a separate chapter devoted to Margaret Crawford, the heroine of that great historical event, appeals to us as a highly sympathetic document.

The make-up of the book is excellent and adds its share to the prominent place the work should occupy both in public and private libraries.

DO American physicians fully realize that the modern art of medical illustrating originated in this country and in our own days? Art there was—highest, noblest art—when Vesalius, Albrecht Duerer, and Rembrandt and their contemporaries drew or etched or painted anatomical subjects. But in the centuries following less and less attention was given to the subject of medical pictures until the task of illustrating medical works was, with but occasional exceptions, left to mediocre talent and we have only to remember our text books as late as 1900 to recognize how insignificant a part pictorial art played in the education of the student. A very important change took place in 1899 when Howard Kelly's *Operative Gynecology* appeared adorned with illustrations of an heretofore unknown excellence. The illustrator, Max Broedel, a young art student recently from Leipzig, brought to his work not merely superior skill but also the accuracy of a genuinely scientific observer, and he at once set a standard that had since been equalled only by a few other artists and excelled by none. Another significant development occurred recently, and likewise in this country, when a chair of the relationship of Art to Medicine was endowed at Johns Hopkins University; and it is there that Max Broedel, the first incumbent of this new professorship, is conducting a training school for competent medical artists.

All this, of course, is not a book review. Rather it is a trend of thought which is called forth by reading a French manual of obstetrics,[2] which by its fourth edition, has sufficiently demonstrated its practical value to generations of medical students. In contrast, however, to the conciseness of its text which leaves little room for criticism, the inadequacy of its illustrations is very apparent, and as teachers we can not insist too strongly on the importance of instructive pictures as an effective aid to the spoken or printed word.

[1] Ephraim McDowell, "Father of Ovariotomy" and Founder of Abdominal Surgery. By August Schachner, M.D., F.A.C.S. Philadelphia and London: J. B. Lippincott Co., 1921.

[2] Éléments d'Obstétrique. By Dr. V. Wallich. 4th ed. Paris: Masson et Cie., 1921.

THE intimate relationship between gynecology and obstetrics is well demonstrated in a book[1] which has just come to us from England. Fairbairn, with the help of numerous contributors, presents the entire subject of obstetrics *and* gynecology in *one* rather large volume. Of these contributors, there are quite a few whose names are well-known and honored among us—Ballantyne, for instance, and Eden, Kerr, Whitehouse, Berkeley, Bonney, Jellett, Lockyer—and we are glad to greet the others, feeling from their contributions that the future of our specialty in England is safe in their hands. Where so many writers co-operate, it is impossible to avoid a certain overlapping and repetition, but on the other hand there is in all such collaborations a free expression of individual opinions by which the reader can only gain.

The book is divided into seven large parts. The first of these, entitled "Life History of the Female Reproductive Organs" contains anatomy and physiology and forms the common basis for the succeeding parts. There follow two sections devoted to normal and abnormal reproduction (with an additional part dealing with the infant). Obstetrics, thus, comes first, not only because of its antiquity as contrasted with the extreme modernity of gynecology, but also because no one who has not been through the obstetric mill, can have the judgment demanded by many of the problems presented by the diseases of women. Next in order is the section on diseases of women with numerous chapters and subheadings. It is very pleasing to note that the editor has abandoned the customary anatomic grouping which is decidedly unsatisfactory for purposes of study but has, instead, classified the subject according to diseases wherein the localization in one or the other of the organs and tissues is merely incidental. Such a classification has its obvious advantages as one reads the chapters on, let us say, mechanical lesions or infections. The next section on "Gynecology in Relation to Public Health and Industry" is an expression of the tendency, especially marked in recent years, to think in terms of the community, and not of the individual patient alone. Some of the subtitles, such as "The Rôle of Obstetrics in Preventive Medicine," "Maternity and Infant Welfare Centers," and "Industrial Occupations and the Health of Women Workers," indicate the highly commendable innovation instituted by the editor. The final section deals with operations and other therapeutic procedures, both in gynecology and in obstetrics.

So much for the subject matter, to which may be added that this enormous amount of material has been disposed of in less than 950 pages. But aside from the excellence of the essays presented, the great significance of the work lies in another direction. Several authors, in the past, have written separate textbooks both on gynecology and obstetrics for instance: Hirst in this country; Doederlein, Hofmeier, Fehling in Germany; Berkeley and Eden in England. A few writers have presented the two subjects in *one* volume. Schauta, of Vienna, did it about 25 years ago, and, before him, Peter Mueller, of Berne. But that was at a time when the two subjects had not attained their present expansion. There was an attempt made by Liepmann, of Berlin, to close the gap between the two sister sciences, but unfortunately the war intervened when only two of the projected five or six volumes had been published. It is, therefore, a matter of gratification to see that this laudable idea has been carried out by Fairbairn in so satisfactory a manner. He has clearly recognized that the term "gynecology" in its wider and truer sense means *all* the functions and anomalies of the female reproductive organs and, therefore, includes the phenomena of pregnancy and labor. If there is any criticism to make it is this that only by strict economy of space the entire subject could be encompassed within one volume and that for this reason illustrations had to be curtailed too much. When this book goes to a second edition to which it certainly is entitled, it is hoped that the editor, or rather the publishers will see their way clear so to enlarge the volume as to include a number of additional illustrations. But even in its present form, the work is bound to make many friends among students, practitioners, and specialists.

HERE is an intensely interesting and, so far as the reviewer knows, an entirely novel addition to medical literature. Schwalbe, for many years editor of the *Deutsche medizinische Wochenschrift*,[2] has conceived the idea of publishing a series of brief monographs which deal with errors of diagnosis and treatment and their prevention and are meant to be of help to the general practitioner. There are forty-seven of these pamphlets projected, many of which have already been printed. They cover the entire field of medical practice and emanate from prominent representatives of the various specialties.

I have before me five of these slender, paper-bound volumes—three dealing with gynecology, two with obstetrics. Henkel deals with the diseases of the external genitals, the vagina, and the urinary tract and includes in his contribution gonorrhœa, syphilis, and tuberculosis of the female genitalia. Reifferscheid discusses diseases of the uterus, and v.Jaschke writes on diseases of the ovaries, tubes, and the other pelvic structures. Fehling treats of the prevention of diagnostic and therapeutic errors in labor; and Zangemeister views the puerperium from a similar angle. These authors are teachers with wide personal experience and a large consulting practice, and this enables them to recognize the daily needs of the general practitioner and to point out the most frequent diagnostic and therapeutic mistakes made. Because of the purely practical

[1] Obstetrics and Gynaecology. Edited by John S. Fairbairn, M.A., B.M., B.Ch., F.R.C.P.(Lond.), F.R.C.S.(Eng.). London: Henry Frowde and Hodder & Stoughton, 1921.

[2] Diagnostische und therapeutische Irrtuemer und deren Verhuetung. Frauenheilkunde. Edited by Prof. Dr. J. Schwalbe. Leipzig: Georg Thieme, 1921.

purpose of these monographs, all theoretical discussions, bibliographic references, and historical data have been omitted, nor have extremely rare conditions been taken into consideration. These pamphlets, then, are not to take the place of textbooks—in fact, frequent reference is made to the latter so as to induce the reader to consult his standard works for more exhaustive study.

It is not feasible to give any illustrative selections. Moreover, it must be obvious to the reader that this collection is of real value to the general practitioner—and the specialist, too, will find much to interest and instruct him in these pages. An Italian and a Spanish translation are already under way. An English translation would be highly desirable in the interest of those who do not read German. I feel very strongly that the editor may well be congratulated upon his happy idea and the felicitous manner in which it has been worked out.

A TINY booklet[1] giving in minute detail the technique as instituted by DeLee in the Chicago Lying-In Hospital and Dispensary is mentioned here because I imagine that managers of maternity hospitals or outdoor clinics will be glad to adopt this excellent routine and to equip their students, internes, and nurses with this little pamphlet which may be carried in the pocket or satchel. To practitioners who take care of parturient women in their homes, this booklet is warmly to be recommended.

[1] The Technic of the Chicago Lying-In Hospital and Dispensary. By J. B. DeLee. M.D., 1921.

BOOKS RECEIVED

Books received are acknowledged in this department, and such acknowledgment must be regarded as a sufficient return for the courtesy of the sender. Selections will be made for review in the interests of our readers and as space permits.

THE SURGICAL EXPOSURE OF THE DEEP-SEATED BLOOD VESSELS. By J. Fiolle, M.D., and J. Delmas, M.D. Translated and edited by Charles Greene Cumston, M.D. London: William Heinemann, Ltd., 1921.

THE SURGICAL TREATMENT OF NON-MALIGNANT AFFECTIONS OF THE STOMACH. By Charles Greene Cumston, M.D., and Georges Patry, M.D. With an introduction by Sir Berkeley G. A. Moynihan, K.C.M., G.C.B., M.S. London: William Heinemann, Ltd., 1921.

THE MEDICAL DEPARTMENT OF THE UNITED STATES ARMY IN THE WORLD WAR. Volume XV—Statistics. Part I—Army Anthropology. Prepared under the direction of M. W. Ireland, Surgeon General of the Army, by Charles B. Davenport and Albert G. Love. Washington: Government Printing Office, 1921.

ABDOMINAL PAIN. By Prof. Dr. Norbert Ortner. Authorized translation by William A. Brams, M.D., and Dr. Alfred P. Luger. New York: Rebman Company, 1922.

PROCEEDINGS OF THE FIFTEENTH ANNUAL MEETING OF THE ASSOCIATION OF LIFE INSURANCE PRESIDENTS HELD IN THE HOTEL ASTOR, NEW YORK, DECEMBER 8 AND 9, 1921.

THE MECHANICS OF THE DIGESTIVE TRACT. By Walter C. Alvarez, M.D. New York: Paul B. Hoeber, 1922.

AN INTRODUCTION TO DERMATOLOGY. By Normal Walker, LL.D., M.D., F.R.C.P. 7th ed. New York: William Wood & Co., 1922.

PAPERS FROM THE MAYO FOUNDATION FOR MEDICAL EDUCATION AND RESEARCH AND THE MEDICAL SCHOOL. Vol. i—1915–1920. Philadelphia and London: W. B. Saunders Company, 1921.

THE AMERICAN ILLUSTRATED MEDICAL DICTIONARY. By W. A. Newman Dorland, A.M., M.D., F.A.C.S. 11th ed., revised and enlarged. Philadelphia and London: W. B. Saunders Company, 1922.

CLINICAL ELECTROCARDIOGRAPHY. By Frederick A. Willius, B.S., M.D., M.S. (Med.). Philadelphia and London: W. B. Saunders Company, 1922.

NEOPLASTIC DISEASES; A TREATISE ON TUMORS. By James Ewing, A.M., M.D., Sc.D. 2d ed., revised and enlarged. Philadelphia and London: W. B. Saunders Company, 1922.

OPIATE ADDICTION; ITS HANDLING AND TREATMENT. By Edward Huntington Williams, M.D. New York: The Macmillan Company, 1922.

CORRESPONDENCE

REMARKS ON BIOGRAPHY OF EPHRAIM McDOWELL BY AUGUST SCHACHNER

To the Editor: In the foreword, the author gives as the motive which prompted this work,[1] the errors and deficiencies characterizing previous biographies of this, the greatest of the pioneer surgeons of America. He states: "Writers have not only copied from one another without investigation, thus perpetuating errors, but in some instances the same writers have contradicted themselves." On page 285 we find the following: "Hence most of the early sketches judged from this viewpoint were not only made prematurely, but seemingly were largely based upon information transmitted from his generation to the next, and apparently accepted without any reservation or special effort at verification." Again, in an address by the author, published in this volume, we find these words (p. 264): "Doctor McDowell has been more than ordinarily neglected, although the Kentucky State Medical Association did erect in the year 1879 a monument at Danville to his memory." Throughout the entire volume this conception as to the imperfection and inadequacy of all preceding efforts to perpetuate McDowell's memory and achievements seems to dominate the author's mind, and supply the need for a more complete exposition of the subject. As a matter of fact, none of the great pathfinders in American Medicine and Surgery has elicited more careful study and received such distinguished honor from the succeeding generation as has "the Father of Ovariotomy."

Doctor McDowell died in 1830. In 1852 Dr. Samuel D. Gross, then a resident of Louisville, read his biography of Ephraim McDowell, afterward incorporated in Gross' American Medical Biography, to the Kentucky State Medical Society. With rare discrimination and persistent energy, Professor Gross sought out by correspondence and personal interview the associates, relatives, and former patients of McDowell, gathered together the published reports of his operations, and wrote a biography which is a model of accuracy and appreciation. As to the essential facts relating to McDowell's life-work, his character and his surgical ideals, little has been added to, or subtracted from, Gross' original paper.

In 1873 Dr. John Davies Jackson, of Danville, Kentucky, a physician of exceptional literary and scientific attainments, published a biographical sketch of McDowell. Referring to Gross' biography, he says: "He (Doctor Gross) has gone over the field, as we have found out, with extraordinary labor and care, and his conclusions and comments upon the character of the subject of his sketch, as we have verified them through the remaining contemporaries of McDowell, are most just and discriminating."

In 1879 the dedication of the monument erected at Danville to the memory of McDowell by the Kentucky State Medical Society was the most imposing and impressive occasion in the annals of the medical profession of Kentucky. The dedicatory address was delivered by Professor Gross before a large audience, composed of members of the society, distinguished physicians and surgeons from distant states, officials of the state and citizens of Danville and vicinity. The classic address of Professor Gross, together with other addresses and letters incident to the occasion, were published in a handsome volume, bearing within a steel engraving of McDowell, and widely distributed. The international reputation of Professor Gross did much to carry his message throughout the world.

In 1909, when a century had elapsed since McDowell's first ovariotomy, the American Gynecological Society held a meeting in his honor. This centennial celebration took place in New York City, thus making the event distinctly national in character. Papers were presented by Fellows of the Society upon McDowell's original surgical work and its growth in America. Herbert R. Spencer, of London, read a paper on the "Evolution of Ovariotomy in Great Britain"; Professor Pozzi, of Paris, gave the history of the operation in France, and Professor Hoffmeier, of Wurzburg, treated the subject in relation to Germany. Each of these distinguished foreign surgeons presented his paper in person. The volume of transactions containing these papers and other proceedings honoring McDowell's memory is marked by distinctive binding bearing the title "McDowell Centennial."

Space will not permit an enumeration of the other proceedings and publications at home and abroad which honor the name of Ephraim McDowell. Upon the pages of every modern treatise on surgery and gynecology, and throughout medical literature, his name will be found.

It is apparent that the author of the book under review has made a diligent study of the literature relating to McDowell, and from many of the publica-

[1] Ephraim McDowell, "Father of Ovariotomy" and Founder of Abdominal Surgery. By August Schachner, M.D. Philadelphia: J. B. Lippincott Co., 1921.

tions enumerated he quotes; yet he seems at times to detach himself from recognized facts to indulge in such extreme statements as "Doctor McDowell has been more than ordinarily neglected, etc."

On page 222 the author in alluding to the removal of the remains of McDowell and his wife from the family burying-ground to McDowell Park in Danville makes an erroneous statement, which does injustice to the committee which performed this duty for the venerated dead. He states that he was informed "that the McDowell grave remained open following the re-interment, as those in charge were unable to decide whether the remains of Mrs. McDowell should be removed with those of her husband. Strange to say, this remained an open question for some years, until it was finally referred to Dr. J. M. Toner, of Washington, who settled it by directing that the remains of Mrs. McDowell be placed by the side of her distinguished husband, where they naturally belonged."

The writer of this review as chairman of the McDowell monument committee personally employed the undertaker who made the removal and superintended the same. Both bodies were exhumed on one and the same day, carried in the same conveyance, and re-interred, side by side, at the base of the monument in McDowell Park. In a work so elaborate in details as the book under review, such a statement based upon rumor should not have been recorded when the facts could easily have been obtained from official sources.

It is to be hoped that other biographies of McDowell will be written. Indeed, it would be well if the American College of Surgeons would establish a lectureship in his honor, similar to the Hunterian Oration in England, in order to keep before the profession his high scientific ideals, the example of his courage and self-reliance, and his exalted conception of his duty to humanity. To do this, however, it is not necessary to discredit the work of those who rescued his name and fame from oblivion, placed a monument over his grave, and won for him the grateful recognition of surgeons throughout the civilized world.

LEWIS S. MCMURTRY.

Louisville, Kentucky.

AN ORIGINAL OPERATION UPON A DOUBLE UTERUS

To the Editor: After a careful review of the literature, I find so little written upon the subject of double uterus that I am led to believe my experience to be unusual. I have seen 2 cases of pregnancy in double uterus and one pregnancy in a single uterus with a double vagina, besides a considerable number having the same deformity without pregnancy.

The first case of pregnancy in a double uterus was encountered when giving relief to a case of incomplete abortion. This case, after recovery, disappeared from my view. The only suggestive factor was that this woman was an habitual aborter, this having been the fifth spontaneous abortion.

The pregnancy with double vagina was without interest, except that the partition divided the vagina into two large cavities, one not communicating with the cervical canal. After excision of partition the baby was born without difficulty.

The subject of this paper has to do with the second case of pregnancy in a double uterus, the history being as follows:

Mrs. Kate M. of Middlebury, Pennsylvania, was admitted to the Williamsport Hospital as a private case on July 2, 1914, accompanied by her family physician, Dr. C. W. Sheldon, of Tioga, Pennsylvania.

Examination disclosed a young woman of twenty-five, married 2 years, no pregnancies, menses normal, morning nausea, mammary enlargement, who while bathing had discovered a lump in the lower abdomen. We made an investigation, and thought the condition a pregnancy with a tumor of fair size, anterior to internal os. The patient lived about one hundred miles from the hospital, therefore all discussion as to variety of tumor was purely academic. It might be a dermoid, but it mattered not to the patient. She was frightened and desired an operation to safeguard her future.

July 4, 1914, a laparotomy was made disclosing a double uterus with pregnancy in one barrel. The left pregnant side was greatly distended, with a 3 months' pregnancy; the uterus had enlarged laterally, and the wall was so thin that the fœtus could easily be felt and shadow seen. It seemed clear that if the pregnancy were left, rupture would surely occur; therefore we did a hysterotomy and removed fœtus and placenta.

Examination of interior of uterus disclosed a firm, thick walled septum, extending from fundus to cervix, and it seemed that the uterine compartments must have been of nearly equal size prior to pregnancy. I massaged the uterus and involution proceeded rapidly. At this point it occurred to me that it might be possible to make one uterine cavity by removal of septum, as we did in operating upon double vagina. I, therefore, carefully excised the septum, after splitting the uterus to a point well below internal os, but not to end of cervix. Upon anterior surface of uterus, we excised all that portion of uterus occupied by partition, and upon the floor of uterus carefully excised a V-shaped segment, containing partition base well into muscularis. One layer of No. 1 gut closed end of endometrium over V-shaped incision in floor of uterus, and by biting well into muscularis controlled bleeding and reinforced cut muscle fibers. The anterior wall was closed in the usual manner following hysterotomy, care being taken to control bleeding and approximate peritoneum.

The only feature of the operation which I thought difficult was the removal of the septum in such a manner as to prevent its recurrence, for my experience with double vagina had taught me these partitions will reform if merely torn through. Consequently, the suture of the floor of the uterus was carefully and gently done.

The patient made an uneventful recovery, and passed from my notice until July 2, 1921, 7 years

later, when I received a reply to my note of follow-up, as follows:

"Your letter received and am glad to tell you that I have had fine health since my operation in 1914.

"Have had two babies since that time, one born in November, 1915, and one in March, 1918. Didn't have any trouble at either time, and both are strong healthy girls. Am still having good health at this time."

You will note from Mrs. M's letter she has had two babies; the first one born 16 months after operation, and one 3 years later, which, of course, proves that our attempt at conservatism met with success, and that the present-day teaching of hysterectomy in these cases is not justifiable and not in accord with modern conservatism.

H. J. DONALDSON, M.D., F.A.C.S.
Williamsport, Pennsylvania.

A CURED CASE OF INFILTRATING OSTEOGENIC BONE SARCOMA

THIS case is reported for the sole reason that it is the longest case on record of a cure of the above disease that has met the requirements in the way of proof laid down in the effort to get at the true results in this disease by Drs. Codman, Bloodgood, and Ewing. The case has remained well since amputation of the leg on August 5, 1909.

W. B. entered the Hartford Hospital, history number 48,703, in May, 1909, with a history that his trouble had begun with a trifling injury in the preceding February. This injury was called a "strain." The patient also thought that this portion of the leg (lower part of femur) habitually rested against the steering post of his automobile. The patient looked run down and thin, but as he gave a history of furunculosis, I was under the impression that he probably had either a periosteitis or an epiphysitis. On May 22, I made an exploratory incision, and found a soft bony tumor. The bone was readily broken up into the depths of the epiphysis and the joint was avoided with some difficulty. Sections of tissue taken at this operation were reported to me as osteomyelitis. Study of these sections at a later time showed a little piece of undoubted sarcoma on one edge of the slide, which had been overlooked by the pathologist. Confused by this first report, I had to revise my clinical diagnosis of sarcoma, and treat the condition as an inflammation.

The young man continued to lose weight and color and a pulsating tumor soon filled the wound. X-ray pictures on July 17 gave the appearance of a circumscribed sarcoma, but I could not say positively that it was not an osteomyelitis. These X-ray pictures have unfortunately been mislaid and cannot now be found. The patient's leucocytes were 8,000 and there was no fever. The von Pirquet test at this time was positive, but there was no response to the subcutaneous injection of 1, 3, or 6 milligrams of tuberculin. The patient gave no clinical history of, and has never at any time taken any treatment for, syphilis.

On July 24, I cut the hamstring tendons, straightened the leg, and at the same time did a very extensive total excision of the tumor, which, as I made a note at the time, I believed was a sarcoma. Sections from this operation were reported definitely as a "large round cell sarcoma." The diagnosis was thus corrected. On August 5, 1909, I amputated the leg just above the middle of the thigh. The bone at the point of amputation seemed normal. The stump was closed with a posterior flap. The patient made an uneventful recovery and was discharged from the hospital August 27. He was able to go to work as a chauffeur September 24, and a month later had gained 26 pounds. He is now living and well and is a farmer by occupation.

In response to Dr. Codman's invitation issued to surgeons generally throughout the United States, I sent sections from this case to him and they have been carefully studied both by himself and by Drs. Bloodgood and Ewing.

Dr. Ewing writes: "I was much impressed by your case of bone sarcoma. It appears to be a genuine cure of osteogenic sarcoma by operation. They are certainly very rare."

Dr. Bloodgood writes: "Apparently there is no question that this is a sarcoma."

Dr. Codman writes: March 7, 1921. "After all is said and done your case stands unequalled as the only living cured case of osteogenic sarcoma we know of."

Since then they have verified three other cases, which they have recently reported. (SURGERY, GYNECOLOGY AND OBSTETRICS, March, 1922.)

Other pathologists perhaps might differ with these gentlemen but by their plan of a registry, such sections will be preserved permanently for restudy by anyone interested. Future students are likely to reclassify these tumors of bone, but for the present this case must stand as an instance of amputation saving life, in spite of two primary exploratory operations.

It would appear that the method offered by these three doctors of certifying surgical diagnoses and results, might well be applied to other conditions. If certain standards were demanded for a certified diagnosis of the more rare conditions in surgery and other standard requirements were maintained in respect to the results of operation, surgical literature could be immensely reduced in volume and increased in value. It is sincerely to be hoped that the American College of Surgeons will be able gradually to assume the function of certification in many conditions along some such line as Dr. Codman has initiated in the case of bone sarcoma.

ERNEST A. WELLS, M.D.
Hartford, Connecticut.

AMERICAN COLLEGE OF SURGEONS

MARCH AND APRIL MEETINGS OF STATE SECTIONS OF THE CLINICAL CONGRESS OF THE AMERICAN COLLEGE OF SURGEONS

DURING March and April there were three meetings of state sections of the American College of Surgeons, in Birmingham, Alabama; Asheville, North Carolina; and Allentown, Pennsylvania.

BIRMINGHAM, ALABAMA

The meeting in Birmingham took place March 2 and 3, with headquarters at the Tutwiler Hotel. Dr. Cunningham Wilson, Birmingham, presided.

The states of Louisiana, Mississippi, Alabama, Georgia, and Florida were represented in this group. It would seem evident that the grouping of five states on such an occasion is inadvisable, not only on account of the amount of travel involved for attending Fellows, but because of the somewhat evident lack of complete co-operation arising from the attempt to spread the meeting-interest over five states. Representation from at least two of the states should have been better than it was, and doubtless would have been in a meeting of as small a group as three states.

Ninety-seven Fellows were in attendance.

In addition to the members of the central office, Dr. J. M. T. Finney, Baltimore; Dr. William R. Cubbins, Chicago; and Dr. E. P. Hogan, Birmingham, addressed the hospital conference and the public meeting.

The clinics, as has been found to be the case throughout the South, were well organized and well carried out, with a very encouraging attendance of Fellows.

The hospital conference was attended by about 150.

The public meeting had an attendance of about 300, which number would have been largely increased had the size of the hall permitted it. The addresses of Dr. Finney and Dr. Cubbins were of special interest here to the laity as well as to the attending surgeons and Fellows.

The scientific session was attended by somewhat over 100 and developed quite effective discussions of the papers presented.

ASHEVILLE, NORTH CAROLINA

An interim of two weeks intervened between the meeting of Birmingham and that of Asheville, North Carolina, during which period Mr. Raymond of the central office visited the Fellows of South and North Carolina.

The Asheville meeting, under the executive chairmanship of Dr. Jacob F. Highsmith and under the management of Dr. H. H. Briggs, chairman of the committee on arrangements, proved a high point in the tour of the country. The smaller sessions were held in the Convention Hall of the Battery Park Hotel; the public meeting at the Asheville Auditorium.

There were 117 Fellows in attendance at the group meeting.

Visiting speakers were Dr. John B. Deaver of Philadelphia, president of the College; Dr. John O. Polak, Brooklyn; and Dr. Joseph C. Bloodgood, of Baltimore.

The hospital conference presented the first tryout of the round table discussion in state meetings, in this case led by Superintendent Robert Jolly of Houston. The meeting, being intended to discuss problems and to present assistance to the hospital people as well as to instruct them, succeeded rather effectively through the round table in accomplishing an end. It would appear desirable to establish this as a uniform part of the program for future hospital conferences.

The public meeting Monday night entirely filled the main floor of the Asheville Auditorium. The addresses of Dr. Bloodgood on "Preparedness against Cancer," and of Dr. Polak concerning "Antenatal Care" were of natural and large interest to the audience.

A departure from the usual routine was had in the arrangement of the scientific sessions which occupied the entire second day of the convention, replacing the usual forenoon clinics. The representation of both North and South Carolina on the program was effected, and the papers, many of them illustrated, were presented with unusual care and detail.

The afternoon scientific session was one of especially marked interest owing to the clinic presided over by Dr. Deaver, and participated in by Drs. Bloodgood and Polak, as well as by attending Fellows, speaking from the floor. These cases had been prepared by the Fellows of North Carolina, and the completeness of the diagnostic work and notes made possible a detailed discussion by the speakers in each case.

ALLENTOWN, PENNSYLVANIA

The Fellows of Pennsylvania, Delaware, and New Jersey met in Allentown on April 3 and 4.

Dr. William L. Estes, of Bethlehem, presided, and Dr. C. D. Schaeffer, of Allentown, chairman of the committee on arrangements, carried out one of the most successful meetings that the College has had in this quarter of the year.

The hospital conference was opened by Mayor Gross, of Allentown. In addition to the speakers of the central office, Dr. Polak, Dr. Schaeffer, Dr. Baldy, and Dr. Housman were on the program. This conference reached the high-water mark of all such meetings so far held, there being fully 400 in attendance.

The public meeting at the Allentown High School Auditorium likewise was one of the largest public meetings that has yet been held, over 1300 being present. Of the visiting speakers, Dr. Deaver spoke on "Public Recognition of Scientific Medicine" and Dr. Polak on "Prenatal Care." The co-operation of churches and schools was indicated by the presence on the program of Monsignor Peter Masson, rector of the Church of the Sacred Heart, and the Rev. William F. Curtis, president of Cedar Crest College.

The scientific session was likewise larger than any previously held during the Spring, over 300 being in attendance. Admiral Stitt, surgeon-general of the U. S. Navy, and Professor M. J. Rosenau of Harvard Medical School, addressed the meeting.

Tuesday evening, the Fellows were guests of the Allentown Chamber of Commerce, where 160 members of this body listened to the College program for the betterment of surgery, hospitals, and public health.

COMING MEETINGS

New England States at Portland, Maine, May 15–16.

Nova Scotia, New Brunswick, and Prince Edward Island at Halifax, Nova Scotia, May 19–20.